NUCLEAR SCIENCE ABSTRACTS

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GENERAL AND MISCELLANEOUS

7166 AECL-962

Atomic Energy of Canada Ltd., Chalk River, Ont.

AN OUTLINE OF THE ACTIVITIES OF ATOMIC ENERGY OF CANADA LIMITED AND SOME OF THE ABC'S OF NUCLEAR POWER. Jan. 1960. 53p. (AECL).

A summary of the activities carried on in the Canadian atomic energy program is presented. A brief review of reactor developments is given, and information is included on fundamentals of nuclear power, properties of enriched uranium, and heavy water. Production and uses of isotopes are also described. (J.R.D.)

7167 MND-SR-1675

Martin Co. Nuclear Div., Baltimore.

STRONTIUM 90 POWER PROJECT. Quarterly Progress Report No. IV covering Period July 15, 1959 through October 15, 1959. Oct. 1959. 123p. Contract AT(30-1)-2220, Task II. OTS.

Work aimed at optimizing the fabrication process for manufacturing strontium titanate pellets was completed. It was determined that the quality and insolubility of such pellets depend upon a pure starting material and that any increase in stable contamination can adversely affect the desirable properties. A second ball milling step was incorporated into the blending process to assure fine particle size and complete Sr tieup in the firing operation that follows. Sample pellets prepared from 8 different batches of starting material all resulted in densities above 94% of theoretical. Diameter shrinkage varied from 19 to 21%. Time span in excess of two weeks between calcining and firing was shown to positively decrease final pellet density. Stable corrosion testing of those samples prepared during the ceramic study was completed. Tracer studies of the absolute solubility of Hastelloy C are described. Two conceptual designs were completed for the 100-watt sea-based generator. One design is similar to the land-based device but employs 280,000 instead of 320,000 curies. The second design features a removable biological shield for sub-sea use. Shock, vibration, radiation, and selective atmosphere test units were fabricated and loaded with lead telluride thermocouples. A conceptual design for a land-based 5-watt generator was completed. (For preceding period see MND-SR-1674.) (W.D.M.)

7168 TID-4563(2nd Rev.)

Office of Isotopes Development, AEC.

SPECIAL SOURCES OF INFORMATION ON ISOTOPES. Jan. 1, 1960. 58p.

Selected sources of information are presented on radioisotope applications, availability, and potential value, and sources of educational material and programs of assistance and development. (C.H.)

7169 JPRS-1105-D

COMMUNIST CHINA MAKES GREAT STRIDES IN THE PEACEFUL UTILIZATION OF ATOMIC ENERGY. Sanch'iang Ch'ien. Translated from K'o Hsüeh T'ung Pao, 627-9(1959). 9p. OTS.

Developments in the field of nuclear science in China are reviewed for the period 1949 to 1959. Topics discussed include experimental nuclear physics, cosmic-ray and high-energy physics, and isotopic chemistry and applications of isotopes. (C.H.)

7170

SUMMARIZED PROCEEDINGS OF A CONFERENCE ON ELECTRON MICROSCOPY—EXETER, JULY 1959. J. A. Chapman and M. J. Whelan. Brit. J. Appl. Phys, 11, 22-32(1960) Jan.

Papers presented at a conference on electron microscopy are summarized. The subjects investigated were metal physics, metallurgy, oxidation, wear and corrosion, instrumental techniques, biology, mineralogy, scattering, contrast, and resolution. (C.J.G.)

7171

CHEMICAL-TECHNOLOGICAL PROBLEMS IN THE UTILIZATION OF ATOMIC ENERGY. Karl Winnacker (Farbwerke Hoechst AG, Frankfurt am Main). Chem. Ing. Tech. 31, 301-9(1959) May. (In German)

The peaceful use of atomic energy presents the chemist and chemical industry with new and extensive problems which concern not only production of the fuel and moderator, manufacture of the fuel elements and preparation of the spent atomic fuel, but also the development of new radiation-resistant materials. Furthermore, it makes possible new methods for chemical and technical processes using radioactive fission products; the decontamination of effluent gas and water also produces chemical problems. (auth)

7172

INDUSTRIAL APPLICATIONS OF RADIOISOTOPES. J. M. Gamboa and Y. A. Plata. Energia nuclear (Madrid) 3, No. 12, 65-88(1959) Oct.-Dec. (In Spanish)

The industrial uses of radioisotopes are divided into 3 groups and discussed. Group 1 (effects of material on radiation) includes radiography, densitometry, analytical methods based on radiation penetration, liquid level control, control of packing, and thickness measurement. Group 2 (effects of radiation on materials) includes static electricity elimination, luminescence activation, sterilization of food, and activation of polymerization and other reactions. Group three methods are tracer techniques such as leak detection, following movement of fluids, measurement of wear, and study of corrosion, diffusion, detergency, catalysis, kinetics, and reaction mechanisms. (T.R.H.)

7173
NUCLEAR ENERGY IN THE BALANCE FOR THE ENERGETIC FUTURE. I. Pierre Sevette. Inds. atomiques 3, No. 11-12, 79-85(1959). (In French)

The future of nuclear energy in propulsion, heat production, and electricity generation is discussed. (T.R.H.)

7174
THERMAL INITIATION OF EXPLOSIVES. John Zinn and Charles L. Mader (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys. 31, 323-8(1960) Feb.

Numerical solutions were obtained for the nonlinear heat conduction equations arising in the theory of thermal explosions. Explosion times are calculated for externally heated spheres, cylinders, and slabs of several explosive materials, and the results are shown to agree with experiment. (auth)

7175
NEUTRON ACTIVATION ANALYSIS OF ANCIENT ROMAN POTSHERDS. V. M. Emeleus and G. Simpson (Research Lab. for Archaeology and History of Art, Oxford). Nature 185, 196(1960) Jan. 16.

Thirty-two fragments of Roman samian ware, chosen from factories at which this fine-grained pinkish-red Roman table-ware was manufactured, were analyzed for sodium and magnesium content, using neutron activation and gamma spectrometry. Results are tabulated. The potsherds tended to group regionally. The method is suggested as a means for locating the region of origin of samian shreds which cannot be placed stylistically. (C.H.)

7176
RADIATION SEEKS COMMERCIAL USE. S. Edward Eaton (Arthur D. Little, Inc., Cambridge, Mass.). Nucleonics 18, No. 2, 105-7(1960) Feb.

The Warsaw conference program, sponsored by the International Atomic Energy Agency, shows that many people feel that they are working on processes of practical value. Included are some of the varied uses of radiation. (B.O.G.)

7177
THE PEACEFUL USES OF ATOMIC ENERGY. John Cockcroft (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Proc. Roy. Soc. Med. 52, 487-93(1959) July.

Progress in the large-scale development of nuclear power is reviewed. Generating costs of coal-fired and nuclear power plants are compared. Advantages and disadvantages of various reactor designs are discussed. The prospect of drawing energy from the fusion of light nuclei is considered and some of the reactions which are of most interest for thermonuclear work are discussed. (C.H.)

7178
FINAL REPORT. FINANCIAL PROTECTION AGAINST ATOMIC HAZARDS, WITH SPECIAL REFERENCE TO THE PROTECTION OF THIRD PARTIES. Tokyo, Japan Atomic Industrial Forum, Inc., 1959. 24p. $1.00.

The need of providing State indemnity as a means of financial protection against atomic hazards is stressed. Financial protection laws or bills of the United States, West Germany, Great Britian, and Switzerland are discussed. The status of a Japanese system of financial protection against atomic hazards is reviewed. (C.H.)

7179
PROCEEDINGS OF THE THIRD CONFERENCE ON CARBON, HELD AT THE UNIVERSITY OF BUFFALO, BUFFALO, NEW YORK, [June 17–21, 1957]. New York, Pergamon Press, 1959. 725p.

Separate abstracts were prepared for 32 papers of the 78 included. (C.J.G.)

BIOLOGY AND MEDICINE

General and Miscellaneous

7180 AD-161783
Columbia Univ., New York.
EFFECT OF IONIZING RADIATION ON THE DEVELOPMENT OF OFF-ODORS AND FLAVORS IN PROTEINS. Report No. 4 (Final) [for] period July 1, 1955–December 31, 1956. R. R. Becker. 26p. Project No. 7-84-01-002. Contract DA-19-129-QM-441.

Three compounds have been identified by chromatographic techniques as products of the irradiation of L-phenylalanine in aqueous solution. The three compounds are tyrosine and ortho- and meta- hydroxy-phenylalanine. These products were identified when phenylalanine was irradiated in either neutral or basic solution. When acidic solutions were irradiated, these compounds were not detected. In addition, several other phenolic compounds are formed which can be noted chromatographically, but cannot be identified with the known compounds tested. Irradiation of methionine solutions yielded methionine sulfoxide along with several other unknown ninhydrin- and hexaiodoplatinate-positive spots. Methionine sulfone was tentatively identified as one of the irradiation products. Irradiation of tryptophan either in aerated or deaerated solutions leads to 5-hydroxy-tryptophan, and several other indole-containing compounds which have not been identified. Irradiation of aqueous suspensions of poly-phenylalanine leads to phenolic products which have not been identified. (auth)

7181 AD-161785
New York. Agricultural Experiment Station, Ithaca.
EFFECTS OF RADIATIONS ON STRUCTURE OF FRUITS AND VEGETABLES. Final Report [for] September 1, 1956–August 31, 1957. Z. I. Kertesz. 25p. Contract DA19-129-QM-727.

Gamma-ray softening of apples, carrots, and beets was measured. Model tests were made on pectin, cellulose, and starch to follow radiation degradation. Pectins and cellulose were isolated from irradiated tissues in order to establish the relation between softening and degradation of polysaccharides. (auth)

7182 AD-213485
Swift and Co. Research Labs., Chicago.
THE EFFECT OF SUB-STERILIZING DOSES OF CATHODE RAYS AND GAMMA RAYS ON THE KEEPING QUALITIES OF PORK. Report No. 7 (Progress) [for] May 16, 1958–August 15, 1958. W. M. Urbain. 4p. Project No. 7-84-01-002. Contract QMR&D (Natick) No. 2 (Agreement).

Results are reported from a comparison of the effectiveness of gamma radiation and electron beams of various energies for the sterilization of pork and beef. (C.H.)

7183 AD-213560
Illinois. Univ., Urbana. Coll. of Veterinary Medicine and Agricultural Experiment Station, Urbana.
TO DETERMINE THE EFFECT OF IRRADIATION UPON THE WHOLESOMENESS OF FOOD. Progress Report No. 6 [for] February 1958–September 1958. Elwood F. Reber, Om P. Malhotra, Julius P. Kreier, Paul D. Beamer, H. W. Norton, and N. D. Levine. 18p. Contract DA-49-007-MD-72800.

Non-irradiated beef and beef irradiated at 2.79 and 5.58

megarads was fed to pregnant dogs. The average initial body weights of the whelps borne by four of the dogs were 214, 244, 287, and 332 g. The average weight of a single group at weaning time was 2877 g. Non-irradiated flour and flour irradiated at 37,200 or 74,400 rads was fed to dogs for 52 weeks. No difference was noted in the average weight gained by these groups. Rations containing the beef which was fed to the dogs as previously described were also fed to rats for 11 weeks. The rations contained one mcg of vitamin K per g. The animals remained in excellent condition. (For preceding period see AD-202181.) (J.R.D.)

7184 AD-215336

Nuclear Science and Engineering Corp., Pittsburgh.

STUDY TO DETERMINE NEUTRON DOSAGES BY FOOD IRRADIATION DEVICES. Report No. 9 (Progress) [for] July 10, 1958—January 9, 1959. P. Kruger. 18p. Project No. 7-84-01-002. Contract DA-19-129-QM-741.

A field trip has been completed in which the neutron fluxes generated in several electron linear accelerators of different energies and beam intensities have been measured. Irradiations of canned homogenized chicken were made at these facilities and examined for short-lived and long-lived induced radioactivity. Preliminary results are given in this report for the measured neutron fluxes and short-lived induced activities in the food and tin can containers. Within the uncertainties of the low-level radioactivity detection equipment used, long-lived induced radioactivity was not present in the irradiated homogeneous chicken. Further activation studies are underway. (auth)

7185 AD-218365

Rath Packing Co., Waterloo, Iowa.

AGING OF MEAT BY IRRADIATION. Report No. 2 (Progress) [for] April 25, 1957—October 24, 1957. George Christianson. 6p. Project No. 7-84-01-002. Contract QMR&D (Natick) No. 62.

Fresh beef steaks irradiated at levels of 20,000 to 600,000 reps did not have appreciably greater refrigerated storage life than untreated controls. Gamma irradiation, up to 9,000,000 reps, of natural sheep and hog casings packed in NaCl destroyed all microflora but reduced the bacterial quality of fresh pork sausage made from these casings. (auth)

7186 DASA-1148

New York Naval Shipyard. Material Lab., Brooklyn.

THE BURNS UNDER A "HOT-WET" UNIFORM SPACED FROM SKIN FOR NUCLEAR WEAPON PULSES OF THERMAL RADIATION. Final Report. Guy P. de Lhery, Willard L. Derksen, Edmund A. Garde, Thomas I. Monahan, and George Mixter, Jr. May 12, 1959. 27p. (NML-5046-16(Pt. 7); AD-227095).

The burns to the skin of anesthetized rats were determined for the thermal radiation pulses of a carbon arc on a hot-wet uniform when spaced 5 mm from the skin. The radiant exposures to cause burns resulting in eschar were 14.7, 16.2, 16.3, and 19.7 cal/cm^2 for the thermal radiation pulses corresponding to 250, 1000, 2900, and 10,000 kiloton detonations, respectively. The threshold lesions were caused by volatile products not associated with ignition. The associated temperatures were recorded. (auth)

7187 NP-8196

São Paulo, Brazil. Universidade. Instituto de Energia Atomica.

ALGUNS ASPECTOS DO PROBLEMA DA DETERMINAÇÃO DA VIDA MÉDIA DOS ERITROCITOS COM O EMPREGO DO Cr-51 (RADIOCROMATO DE SÓDIO). (Some Aspects of the Problems of the Average Life of Erythrocytes with the Use of Cr-51 Radioactive Sodium Chromate). R. R. Pieroni. May 1959. 17p.

Analytical expressions were derived for the survival curves of Cr^{51}-labeled erythrocytes. Expressions are obtained for normal erythrocytes, normal erythrocytes transfused into receptors containing a lethal factor, erythrocytes subjected to a lethal factor after formation, and potentially immortal erythrocytes subjected to an exterior lethal factor which destroys them randomly, regardless of age. (J.S.R.)

7188

DEUTERIUM EXCHANGE AND REVERSIBLE DENATURATION OF α-CHYMOTRYPSINOGEN. Philip E. Wilcox (Carlsberg Laboratorium, Copenhagen). Biochim. et Biophys. Acta 34, 602-3(1959) Aug.

Deuterium exchange and reversible denaturation measurements on α-chymotrypsinogen were performed at 39 and 50°C and at pH of 2.0 to 3.4. Complete deuteration occurred rapidly at 39°C near pH 2, where reversible denaturation was appreciable. (C.J.G.)

7189

A CONTROL CIRCUIT FOR A PNEUMATIC-TRANSFER TELETHERAPY UNIT. J. E. Burns and R. E. Trotman (Westminster Hospital, London). Brit. J. Radiol. 33, 63-4(1960) Jan.

A design is described of a control circuit for a pneumatic-transfer teletherapy unit. (C.H.)

7190

INCLUSIONS OF RADIOPHOSPHORUS (P^{32}) INTO DIFFERENT STRUCTURES OF THE HEART. V. V. Frolkis and V. I. Milko (Kiev Medical Inst.). Byull. Eksptl'. Biol. Med. 48, No. 7, 50-3(1959) July. (In Russian)

Experiments were performed on rabbits. There was a definite topography of radiophosphorus (P^{32}) inclusion into different portions and structures of the heart. The intensity of this inclusion decreased in the following sequence: left ventricle (maximal intensity), right ventricle, left auricle, and right auricle. It was also demonstrated that in experimental conditions the radioactivity of the left ventricle is much greater (by 3 to 4 times) than that of the other portions of the heart and blood. The centers or nerve ganglions governing automatic control are characterized by a minimal intensity of the P^{32} inclusion. The inclusion of radiophosphorus is more intense in the elements of the bundle of His than in the spinal and atrioventricular nodes. (auth)

7191

THE ISOTOPE EFFECT IN THE FIXATION OF NITROGEN BY AZOTOBACTER. Thomas C. Hoering and Harrell T. Ford (Univ. of Arkansas, Fayetteville). J. Am. Chem. Soc. 82, 376-8(1960) Jan. 20.

The relative rates of fixation of $N^{14}N^{14}$ and $N^{15}N^{14}$ by Azotobacter were studied. The ratio of these rates is 1.000 ± 0.001. The isotope effect in a heterogeneous reaction, the catalytic hydrogenation of the double bond in azobenzene, was studied. No isotope effect was found. The rate-determining step in the mechanism of these reactions does not involve a change in bonding to nitrogen. The geochemical implications are discussed. (auth)

7192

EFFECT OF HEAVY WATER ON DIFFERENT TYPES OF MUSCLE AND ON GLYCEROL-EXTRACTED PSOAS FIBRES. Benjamin Kaminer (Univ. of Witwatersrand, Johannesburg). Nature 185, 172-3(1960) Jan. 16.

Observations are reported on the effects of heavy water on isolated heart, intestinal, uterine, and voluntary frog muscles. The velocity of contraction and the velocity of

relaxation were both reduced by concentrations of heavy water between 99.8 and 25%. Attempts were made to elucidate the sites where heavy water affected the contraction of muscle. Chemical stimulants such as adrenalin, noradrenalin, and veratrine increased the force of contraction of atria treated with 75% heavy water. The effect of heavy water was also studied on psoas muscle fibers extracted with glycerol, both with and without electrical stimulation. Results indicate that heavy water can be useful as a tool in the dissection of the physical and chemical processes of muscle contraction. (C.H.)

7193

ESTIMATION OF PROTEIN BOUND I^{131} IN PLASMA. Roger P. Ekins (Middlesex Hospital Medical School, London). Phys. in Med. Biol. 4, 182-4(1959) Oct.

A rapid method of estimating protein bound I^{131} in human plasma, using trichloracetic acid precipitation and a well scintillation counter is described. (auth)

7194

A COMPARISON OF THE EFFECTIVENESS OF CERTAIN METHODS OF TREATMENT OF THE CHRONIC LEUKAEMIAS (X-RAYS, RADIOACTIVE PHOSPHORUS, URETHANE, EMBIKHIN, ARSENIC AND MYLERAN). S. I. Sherman, D. S. Kuz'min, L. M. Rozanova, A. N. Kiseleva, N. S. Povergo, and A. D. Vakulenko (Leningrad Order of the Labour Red Banner Research Inst. of Blood Transfusion). Problems Hematol. Blood Transfusion (U.S.S.R.) (English Translation) 4, No. 5, 15-21(1959).

The effectiveness of x radiation, radioactive phosphorus, urethane, embikhin, arsenic, and myleran is discussed for the treatment of chronic myeloid leukemia. Tabulated results are included on 68 patients treated with myleron (myelosan). (C.H.)

7195

EXPERIENCE OF TREATMENT BY RADIOACTIVE PHOSPHORUS OF PATIENTS WITH ERYTHRAEMIA, CHRONIC LEUCOSES, BONE METASTASES OF CARCINOMA, MYELOMA AND LYMPHOGRANULOMATOSIS. E. T. Abasov (Azerbaidzhan Scientific-Research Inst. of Rontgenology and Radiology). Problems Hematol. Blood Transfusion (U.S.S.R.) (English Translation) 4, No. 5, 58-61(1959).

Results are summarized from the application of phosphorus-32 in the treatment of patients with erythremia (polycythemia), chronic leukosis (leukemia), bone metastasis of carcinoma, myeloma, and lymphogranulomatosis (Hodgkin's disease). (C.H.)

7196

DISTRIBUTION STUDIES ON RADIOACTIVE Hg^{203} SODIUM MERCAPTOMERIN IN ANIMALS. Benjamin Calesnik, Arthur Wase, and Vincent R. Altarelli (Hahnemann Medical Coll., Philadelphia). Proc. Soc. Exptl. Biol. Med. 103, 22-5(1960) Jan.

Using Hg^{203} labeled mercaptomerin sodium and studying radioautographs and renal distribution, 91.7% of an intramuscularly injected dose of 1 mg Hg/kg was found in the kidney of the rat within the first hour with maximum concentration occurring in the cortical area. Radioactivity was detected for 28 days in plasma and in renal tissue. Intravenous administration of radioactive mercaptomerin sodium resulted in a rapid decline in plasma concentration during the first 5 minutes. Rate of urinary excretion appears to be a function of arterial plasma-renal vein plasma difference. (auth)

7197

ERYTHROPOIETIN. I. ANALYSIS OF RADIOIRON ASSAY IN FASTED RATS, USING COBALT AS A REFERENCE STANDARD. R. J. Schlueter, H. Norgello, and W. F. White (Armour and Co., Chicago). Proc. Soc. Exptl. Biol. Med. 103, 43-6(1960) Jan.

Radioiron assay of erythropoietin was analyzed and for purposes of inter-lab comparison of erythropoietic activity, the response to 5μM of cobalt, given by subcutaneous injections, is suggested to represent 1 unit of activity. A house standard of partially purified sheep erythropoietin, having a potency of 1 unit/mg, was used to establish a dose-response curve up to 22.4 units/rat. In this range the curve shows an increasing slope to 11.3 units/rat. On the basis of this assay, the potency of several fractions of sheep erythropoietin was given. (auth)

7198

EFFECT OF DIETARY CALCIUM AND PHOSPHORUS LEVELS ON BODY BURDENS OF INGESTED RADIOSTRONTIUM. R. H. Wasserman and C. L. Comar (State Univ. Veterinary Coll., Ithaca, N. Y.). Proc. Soc. Exptl. Biol. Med. 103, 124-9(1960) Jan.

It is emphasized that long term effects of dietary constituents on radiostrontium must be determined either by long term experiments or predicted from double tracer technics. Previous reports in disagreement as to the effect of increased dietary calcium on radiostrontium were reconciled by the following predictions: in immature rats, elevated dietary calcium levels (within physiological ranges) with or without increased phosphorus levels would almost proportionately reduce the body burden of dietary radiostrontium; in mature rats; elevated dietary calcium levels alone would not proportionately reduce the radiostrontium; and in mature rats, simultaneous increases in dietary calcium and phosphorus levels would to some degree reduce the ultimate body burden of radiostrontium. (auth)

7199

ERYTHROPOIETIC FACTOR IN KIDNEY TISSUE OF ANEMIC DOGS. Jean-Pierre Naets (Univ. of California, Berkeley). Proc. Soc. Exptl. Biol. Med. 103, 129-32 (1960) Jan.

Homogenates of kidney, liver, and spleen tissue from normal and anemic dogs were assayed for erythropoietic activity by their effect on Fe^{59} red cell incorporation in starved rats. A slightly higher incorporation resulted from administration of an extract of anemic kidney than from extract of normal kidney or anemic liver or anemic spleen. This difference was sufficient to suggest the importance of developing methods for concentrating and purifying the erythropoietic activity of tissue homogenates to help clarify the role of kidney in production of erythropoietin. Methods for fractionation and concentration are being investigated. (auth)

7200

TRANSPLANTATION OF LEUKEMOID LEUKOCYTES IN IRRADIATED MICE. L. H. Smith, R. A. Popp, and W. St. Amand (Oak Ridge National Lab., Tenn.). Proc. Soc. Exptl. Biol. Med. 103, 232-4(1960) Jan.

Using hemoglobin markers to identify donor- and host-type erythrocytes, it was demonstrated that cells in the leukocyte fraction of leukemoid blood are capable of transplanting and giving rise to mature erythrocytes of donor type in lethally irradiated mice. Autoradiograms showed that several cell types in leukemoid blood incorporate H^3-thymidine in vitro. (auth)

7201

MITOTIC ARREST BY DEUTERIUM OXIDE. Paul R. Gross and William Spindel (New York Univ.; Rutgers

State Univ., Newark, N. J.; and Marine Biological Lab., Woods Hole, Mass.). Science 131, 37-9(1960) Jan. 1.

The effects of varying concentrations of D_2O on fertilization and cleavage in the eggs of a sea urchin and an annelid were studied. D_2O was found to produce arrest of, or serious delay in, mitosis and cytokinesis. All stages requiring assembly or operation of mechanical structures in the cytoplasm were found sensitive to D_2O. The block was found to be reversible in some cells. (auth)

Biochemistry, Nutrition, and Toxicology

7202 NP-8197

São Paulo, Brazil. Universidade. Instituto de Energia Atomica.

DEPURAÇÃO DA VITAMINA B-12 (Co-60) INJETADA NA REGIÃO DELTOIDIANA. (Clearance of Vitamin $B_{12}(Co^{60})$ Injected in the Deltoid Region). R. R. Pieroni, V. Maspes, and M. A. Jamra. May 1959. 12p.

A comparison was made of the clearance of vitamin B_{12} injected in aqueous medium and in gelatinous medium in the deltoid region. The radioactivity injected was approximately 0.5 c. The results are compared with published data on the clearance of sodium chloride. (J.S.R.)

7203 NP-8198

São Paulo, Brazil. Universidade. Instituto de Energia Atomica.

RECUPERAÇÃO URINÁRIA DA VITAMINA B-12(Co-60) ADMINISTRADA POR VIA PARENTERAL. (Urinary Recovery of Vitamin $B_{12}(Co^{60})$ Administered Parenterally). R. R. Pieroni, Alcídio Abrão, V. Maspes, and M. A. Jamra. May 1959. 7p.

A study was made to determine if the results on the clearance of vitamin B_{12} from rats could be applied to humans. The hypothesis on the degradation of vitamin B_{12} was also investigated. The results obtained show that the activity is eliminated by the urinary tract instead of in the feces as in rats. The Co^{60} activity of the urine could not be attributed to the degradation of the vitamin B_{12}. (J.S.R.)

7204 UR-562

Rochester, N. Y. Univ. Atomic Energy Project.

THE CHEMICAL TOXICITY OF THORIUM DIOXIDE FOLLOWING INHALATION BY LABORATORY ANIMALS. H. C. Hodge, E. A. Maynard, and L. J. Leach. Jan. 5, 1960. 33p. Contract W-7401-eng-49. OTS.

Short-term inhalation studies of thorium dusts, soluble or insoluble, inhaled by laboratory animals in high concentrations for short periods, gave practically no evidence of chemical toxicity. Because toxic effects unpredicted from short-term studies sometimes appear in protracted exposures, a one-year inhalation study of thorium dioxide at an atmospheric concentration of 5 mg Th/m^3 was conducted. This study confirmed the inertness of thorium in the body. The retention of thorium in the tissues was followed in serially sacrificed dogs and rats. The data indicate appreciable accumulation of thorium in the lung. For example, for the dog and the rat the lung values averaged 183 and 121 μg Th/g fresh lung, respectively, at the end of the one-year exposure. Of the tissues examined (lung, liver, kidney, spleen, and bone) only the lung showed an increased thorium content with increased exposure. This is demonstrated when the average lung values after one month exposure for the dog (28 μg Th/g) and the rat (31 μg Th/g) are compared with the one-year values. This 5-fold increase was not seen in any of the other tissues examined. (auth)

7205 JPRS-L-1169-N

ACCELERATION OF THE ELIMINATION OF RADIOACTIVE ISOTOPES FROM THE ORGANISM UNDER THE EFFECT OF COMPLEX-FORMING COMPOUNDS. V. S. Balabukha and G. Ye. Fradkin. Translated from p.44-85 of Nakopleniye Radioaktivnykh Elementov v Organizme i Ikh Vyvedeniye, Moscow, 1958. 42p. OTS.

Results are reported from a study of the effects of complex-forming compounds on the elimination of radioactive isotopes from animals. Data are tabulated on the effects of the sodium and calcium salts of ethylenediaminetetraacetic acid and the sodium salt of nitriloacetic acid on the excretion of yttrium-91 in rats. Problems involved in the selection of complex-forming compounds are discussed. Data are included from an analysis of the accelerating effect exerted by complex formers after injury with radioactive isotopes and the relation between the structure of organic compounds and their complex-forming power. Possibilities of utilization of the phenomenon of natural complex formation for the purpose of removing radioactive isotopes from the body and routes and methods of acceleration of the excretion of radioactive strontium isotopes are discussed. (C.H.)

7206

INCORPORATION OF TRITIUM-LABELLED THYMIDINE AND TRITIUM-LABELLED DEOXYCYTIDYLIC ACID INTO DEOXYRIBONUCLEIC ACID AFTER IRRADIATION OF THE DEOXYRIBONUCLEIC ACID PRIMER WITH γ-RAYS. S. Okada (Univ. of Rochester, N. Y.). Nature 185, 193-4 (1960) Jan. 16.

Results are reported from a study of the ability of irradiated and non-irradiated desoxyribonucleic acid to incorporate tritium-labeled thymidine or tritium-labeled desoxycytidylic acid in the presence of the desoxyribonucleic acid-synthesizing enzyme system from regenerating rat liver. Desoxyribonucleic acid isolated from calf thymus was used in all experiments. An aqueous solution of the acid was irradiated with various doses of gamma radiation. Irradiated, as well as non-irradiated, samples were used as primers to study the incorporation of either labeled thymidine or labeled desoxycytidylic acid into desoxyribonucleic acid in the presence of desoxyadenylic acid, desoxyguanylic acid, desoxycytidylic acid, thymidine, adenosine triphosphate, and the desoxyribonucleic acid-synthesizing enzyme system prepared from regenerating rat liver. Results are tabulated. (C.H.)

7207

IRRADIATED MALES ELIMINATE SCREWWORM FLIES. Merrill E. Jefferson (Dept. of Agriculture, Washington, D. C.). Nucleonics 18, No. 2, 74-6(1960) Feb.

In 16 months, three billion sterile flies were produced. The larvae of the screwworm flies are hatched and dropped into sand trays for pupation. Sexual sterility was produced by exposing the pupae to 8,000 r of Co^{60} radiation two days before the appearance of adult flies. This exposure sterilizes the females among the released flies as well as the males to assure that there is no inadvertent contribution to the healthy population. The flies are dispersed at the rate of 100 to 800 per square mile by airplane. A layout of the sterilization facility, safety precautions, and the operational procedure are presented. (B.O.G.)

Fallout and Radiation Ecology

7208

FOOD, FALLOUT AND THE ISOTOPES OF STRONTIUM. J. Hawthorn (Royal Coll. of Science and Tech., Glasgow). Chem. & Ind. (London) No. 42, 1294-8(1959) Oct. 17.

The cycle of strontium-90 fallout from atomic explosions, uptake by plant and animals, and transfer to the human bone by food and metabolism processes is discussed. Analytical procedures for determining radiostrontium in food and animal and human bones are reviewed. (C.J.G.)

7209

THE TRANSFER OF STRONTIUM-90 FROM MOTHER TO FETUS IN MICE. Bo Holmberg, Arne Nelson, and Elsie Wallgren (Research Inst. of National Defence, Sundbyberg, Sweden). Radiation Research 12, 167-72(1960) Feb.

The transfer of Sr^{90} from mother to fetus in mice has been examined after intraperitoneal injection of Sr^{90}. The investigation included the time course of uptake at the end of gestation, the uptake at different stages of gestation, and the fetal uptake after mating at different intervals after the injection. The results have shown that the ability of the fetus to take up strontium-90 appeared after the fourteenth day of gestation, and studies on the nineteenth day indicated an uptake continuing more than 4 hours after injection of the mother. In a third experiment it was demonstrated that Sr^{90} injected in the mother was available to the fetus in undiminished quantity for at least 4 weeks. (auth)

7210

OCCURRENCE OF SCANDIUM-46 AND CESIUM-134 IN RADIOACTIVE FALLOUT. H. L. Krieger (Robert A. Taft Sanitary Engineering Center, Cincinnati) and D. Groche (Technische Hochschule, Stuttgart). Science 131, 40-2(1960) Jan. 1.

The detection of scandium-46 and cesium-134 in fallout material by chemical separation and gamma scintillation spectrometry is reported. While the origin of these materials is not known, possible routes of formation from stable elements are suggested. (auth)

Radiation Effects on Living Tissues

7211 AD-217923

Baylor Univ., Houston, Tex. Coll. of Medicine.

THE INFLUENCE OF TOTAL-BODY X-RAYS ON THE KINETICS OF ERYTHROCYTE ENZYMES AS A BIOLOGICAL DOSIMETER. Progress Report No. IV [for] June 1, 1958 to May 31, 1959. Donald A. Rappoport. 67p. Contract DA-49-007-MD-428.

Stroma free erythrocyte extracts from rats treated with 1000 and 500 r total-body x rays, respectively, showed a marked decrease in guanosine and inosine metabolism and also a decrease in phosphate ester formation. This decrease in metabolism was noted in 1000 r irradiated rats after 24 hours following irradiation and persisted until the animals died 7 days postirradiation. Substrate disappearance gave better replicate results in these experiments than decrease in phosphate ester formation. Erythrocyte extracts from rats irradiated with 500 r also showed decreased guanosine and inosine utilization and a corresponding decrease in phosphate ester formation from 48 hours to 168 hours postirradiation. Replicates were not as consistent in this group as in the group treated with 1000 r x rays; however, there was a definitive decrease in enzyme activity. Adenosine showed only slight changes after irradiation. Erythocyte metabolism of deoxyguanosine, deosyinosine, and deosyadenosine has been studied and the mechanism of phosphate esters, lactate, and acetaldehyde is described. A quantitative method for two dimensional chromatography of phosphate esters is described. (auth)

7212 AD-219136

Ohio State Univ. Research Foundation, Columbus.

THE INFLUENCE OF IRRADIATED FOODS ON THE ENZYME SYSTEMS CONCERNED WITH DIGESTION. Semi-Annual Report for the period September 1, 1957–February 28, 1958. Richard O. Moore. Mar. 15, 1958. 11p. RF Project 748, Report No. 2. Contract DA-49-007-MD-787.

Macro nutrients were irradiated in aqueous solution and subsequent digestibility by alimentary enzymes determined. Pepsin's ability to digest its substrates was not altered by irradiation when the assay was conducted immediately after irradiation. Denatured casein and hemoglobin in solution are not altered by irradiation in their ability to be digested with trypsin; casein is depressed in its ability to be digested with chymotrypsin. Denatured bovine albumin is not affected in its digestibility by either trypsin or chymotrypsin; however, the digestibility of undenatured bovine albumin by these two enzymes is markedly increased due to irradiation. The rate of digestion on 1% potato starch by alpha-amylase is not significantly altered by irradiation; however, irradiation per se appears to hydrolyze starch to some extent; and, thus, the extent of digestion is greater in irradiated samples during the early period of the action. Irradiation likewise ruptures the glycolytic linkage of sucrose in solution and also increases the rate of further hydrolysis by sucrose. The effect of irradiation on fats was to reduce their ability to be digested by lipase. (auth)

7213 AD-220098

National Canners Assn. Washington Research Lab., Washington, D. C.

STUDY OF THE DESTRUCTION OF FOOD POISONING ORGANISMS IN CANNED FOODS SUBJECTED TO IONIZING RADIATIONS. C. W. Bohrer. Report No. 18 (Progress) [for] December 10, 1958 to March 9, 1959. 5p. Project No. 7-84-01-002. Contract DA-19-129-QM-445.

The inoculated pack studies using Clostridium botulinum in five food products to determine radiation sterilizing doses are continuing. Counts and toxin testing on 6 unspoiled, incubated cans of pork at each level of radiation are reported. After 1 year of incubation, the 3 remaining products will be tested for toxin, counts made, and positive tubes checked for toxin. (auth)

7214 AD-220362

National Canners Assn. Western Research Lab., Berkeley, Calif.

DETERMINATION OF RELATIVE RESISTANCE OF SELECTED STRAINS OF CLOSTRIDIUM BOTULINUM TO IONIZING RADIATIONS. Progress Report No. 2 for November 14, 1958–January 13, 1959. Charles T. Townsend. 6p. Contract DA-19-129-QM-1184.

A comparison was made of the radiosensitivity of spores of 18 strains of Clostridium botulinum. Data are tabulated. (C.H.)

7215 AD-220750

Ohio State Univ. Research Foundation, Columbus.

EFFECT OF X-IRRADIATION ON CELLULAR METABOLISM. Annual Report for Period August 1, 1958–July 31, 1959. Milton A. Lessler. Aug. 1959. 13p. RF Project 513. Contract DA-40-007-MD-293.

Further studies of the metabolism of human erythrocytes stored under standard blood bank conditions indicate that erythrocytes stored in blood packs have significantly lower levels of respiration than unstored cells. Comparison of unirradiated and irradiated aliquots indicate that the increased respiration noted after 700 r or 1400 r was significant only at 0 (freshly drawn blood), 2, and 4 days.

Liver slices, used as an example of a radioresistant tissue, were subjected to 25, 100, or 200 x irradiation during respiratory measurements with no significant change in respiration. Spleen slices, a radiosensitive tissue, were exposed to 65, 250, or 500 r during respiratory measurements. There was a significant depression in the respiration of spleen cells at all levels of radiation used in these in vitro tests. (auth)

7216 AD-225107

Western Biological Labs., Venice, Calif.

EFFECTS OF X-IRRADIATION DURING THE FORMATIVE PERIOD OF TOOTH DEVELOPMENT ON THE TEETH AND PERIODONTIUM OF RATS AND THE EFFECTS OF SUCH TREATMENT ON SUBSEQUENT CARIES SUSCEPTIBILITY. Progress Report [for] January 1, 1959 to August 15, 1959. B. H. Ershoff and L. A. Bavetta. 7p. Contract DA-49-007-MD-768.

Previous studies indicate that exposing mother rats to 150 r x irradiation on the 10th day of pregnancy significantly increased both the incidence and severity of dental caries in young subsequently fed a purified high carbohydrate diet. Experiments were conducted to determine the effects of various dietary supplements on the severity and incidence of caries induced by the procedure. Alfalfa ash and the ash derived from Rockland Rat Diet when fed at a 5% level in the purified diet completely prevented caries in these animals. Na_2HPO_4 at a 2% level in the diet was without significant effect. Hubbell, Mendel, and Wakeman Salt Mixture at a 5% level in the diet had only moderate activity. Casein at a 10% level had some activity. Other supplements tested including supplements of the known vitamins, 5% cottonseed oil, 10% cellulose, 10% desiccated liver N.F., 10% Torula yeast and 20% alfalfa meal had little if any protective effect. (auth)

7217 AF-SAM-59-30

Albert Einstein Medical Center. Radiology Dept., Philadelphia.

THE METABOLISM OF THE RADIATION PROTECTIVE AGENT 2-AMINOETHYLISOTHIURONIUM BROMIDE HYDROBROMIDE IN MICE AND ITS ALTERATION BY RADIATION. Bernard Shapiro. Dec. 1959. 13p.

A study has been made of the forms of 2-aminoethylisothiuronium bromide hydrobromide (AET) which appear in the serum, liver, spleen, kidneys, and urine of control and irradiated mice following an intraperitoneal injection of this radiation protective agent. Paper chromatography, paper electrophoresis, and S^{35} labeled AET of high specific activity were utilized for the analyses. Compounds which behave chromatographically and electrophoretically like MEG, GED, sulfate, and taurocyamine have been observed in serum and in the organ homogenates. A large portion of the radioactivity is protein bound. The agent is rapidly excreted in the urine as mercaptoethylguanidine (MEG). Over a period of 30 minutes following injection, the protein-bound form decreases and sulfate increases in control mice. Irradiation appears to accelerate this process. It is suggested that acceleration of sulfur metabolism may play a role in the mechanism of radiation damage. (auth)

7218 AF-SAM-59-71

Brooklyn Coll., New York. Biology Research Lab.

SERUM ENZYME ACTIVITY IN THE RABBIT FOLLOWING WHOLE-BODY IRRADIATION. Harry G. Albaum. Feb. 12, 1959. 8p.

Data are presented on alterations in serum enzyme activity following whole-body irradiation of rabbits at a dosage level of 750 r. Of the 14 enzymes investigated, no single enzyme was shown to be a better early indicator of radiation trauma than glutamic oxalacetic transaminase. Evidence is presented that at least 3 of the enzymes are significantly lower in the serum of irradiated animals 6 hours after radiation than they are in the sham controls, suggesting either inactivation or interference with synthesis. Of the 14 enzymes studied, 4 were significantly elevated, 3 were lowered, and 7 remained unchanged within an interval of 24 hours after exposure. (auth)

7219 ORO-237

Longwood Coll., Farmville, Va.

THE EFFECTS OF RADIATION ON ROOT GROWTH OF HIGHER PLANTS. [Final Report]. Robert T. Brumfield. Jan. 25, 1960. 24p. Contract AT(40-1)-1676. OTS.

Progress is reported in studies on the effects of ultraviolet radiation, x radiation, and alpha particles on cell growth and division using the primary seedling root of timothy (Phleum pratense) as the test object. Modifications produced by various chemical treatments are reported. (C.H.)

7220 CEA-tr-R-730

SUR QUELQUES QUESTIONS CONTROVERSÉES DE RADIOBIOLOGIE. (Some Controversial Questions in Radiobiology). M. A. Movsesyan (Movsessian). Translated from Vestnik Rentgenol. i Radiol. 33, No. 3, 58-9(1958). 6p.

A brief discussion is given of the stimulating effect of ionizing radiation in nature, specificity and non-specificity of radiations, and direct versus indirect or local versus general irradiation. (T.R.H.)

7221

THE EFFECTS OF EXPERIMENTAL X-RADIATION ON THE CORNEA. Frederick C. Blodi (State Univ. of Iowa, Iowa City). A.M.A. Arch. Ophthalmol. 63, 20-9(1960) Jan.

Corneal lesions are described which were produced by irradiating rats' eyes and shielding the rest of the body. The retrobulbar injection of cysteine failed to protect the cornea against the radioinduced lesions. (C.H.)

7222

ROENTGEN REGRESSION AND ROENTGEN STIMULATION IN AXOLOTL (SIREDON MEXICANUM). Victor V. Brunst (Roswell Park Memorial Inst., Buffalo). Acta Unio Intern. contra Cancrum 15, 568-76(1959). (In English)

In the axolotl (Siredon mexicanum, a Urodela amphibian) roentgen regression or roentgen reduction is a more or less rapid decrease in size of the treated portion of the body. The reduction process is distinctly related to the presence in these tissues of a great number of giant cells (macrophages), and their destructive activity. Roentgen regression may be closely related to roentgen stimulation. A paradoxical phenomenon exists in which roentgen rays produce two opposed effects, inhibition and stimulation. Similarly, in mammals roentgen rays produce both an inhibitory and a cancerogenic effect. The cancerogenic effect may appear at the same time as either the inhibitory effect or the secondary stimulating effect. It is possible that difference between the stimulating and cancerogenic effects does not exist and that distinction between them is artificial. (auth)

7223

COMPARATIVE STUDY OF THE CARCINOGENIC EFFECT OF A SINGLE DOSE OF X RAYS IN TOTAL, SUBTOTAL AND LOCALIZED IRRADIATION OF THE RAT. J. Maisin, P. Maldague, A. Dunjic, and H. Maisin (Institut du Cancer, Louvain, Belgium). Acta Unio Intern. Contra Cancrum 15, 640-49(1959). (In English)

Total and subtotal irradiation with a single dose increases significantly the cancer incidence in rats. Local irradiation during which a large part of the body is protected by means of a lead shield gives a cancer yield which is function of the irradiated region. Thus the local irradiation of the abdominal cavity gives a high rate of cancers 20.5% whereas the spontaneous incidence of cancers in rats is about 2.8%. A chemical radioprotector such as cysteamine has no protective effect whatever on the cancer incidence observed after total irradiation. It seems, on the contrary, that by suppressing the selective early mortality an increase of the rate of radio cancers is induced. The grafting of isologous bone marrow does not prevent the appearance of cancers in rats. On the contrary, as did cysteamine, it allows a greater number of animals to present cancers. There seems to exist threshold doses for the induction of cancer by x rays. These threshold doses appear to be different for each irradiated organ or tissue. The rupture of the endocrine equilibrium of sexual hormones seems to favor the genesis of cancers in the genital region. The particularly long latency period for certain types of cancers requires for the study of their induction mechanism a long survival, approaching the normal life span. This assesses the importance of local irradiations in the study of the genesis of cancer by x rays. The mechanism of carcinogenesis by x rays is a complex phenomenon that necessitates a very long latency that cannot be explained by an ordinary somatic mutation. A particularly attractive hypothesis would be the induction in the irradiated regions of a phenomenon similar to the LVOV phenomenon in bacteria. (auth)

7224

ESTABLISHMENT OF RESISTANCE TO THE GROWTH OF EHRLICH ASCITES CARCINOMA IN C57 BLACK MICE. Ralph W. McKee, Eugene Garcia, M. Richard Troeh, and William Schultz (Univ. of California, Los Angeles). Acta Unio Intern. contra Cancrum 15, 955-9(1959). (In English)

By x irradiation it has been possible to alter the Ehrlich ascites carcinoma cells in such a way that their viability is lowered. The C57BL mice are consequently able to control the growth of these altered cells. Simultaneous with the slowed rate of growth of the cells the host produces a resistance to the cancer cell. The resistance, however, does not reach a level adequate to protect the mouse against fully viable cells until at least five injections of the altered cells have been made. Of 50 mice receiving five to eight injections of the x-irradiated cells 47 survived a challenge of viable cancer; of 47 given a second challenge 39 survived; of 13 given a third challenge 11 survived; of 8 given a fourth challenge all 8 survived; of 6 given fifth, sixth and seventh challenges all 6 survived and of 2 given an eighth challenge 2 survived. Evidence for the resistance factor being an antibody is presented in the demonstration of complement-fixing materials. This presently is being evaluated further and quantitated. Oxidative and glycolytic studies of the x-irradiated cells, and of those cells showing regression in the mouse, have a somewhat altered metabolism. There is at least a partial recovery of the viability of the x-irradiated cells as they grow and regress, indicated by their ability to kill mice that have not previously been given the altered cells. (auth)

7225

RELATION OF HEPATIC KETOGENESIS TO RADIATION-INDUCED DECREASE IN FASTING KETONEMIA. Joseph A. Ontko (School of Aviation Medicine, Randolph AFB, Tex.). Am. J. Physiol. 198, 33-6(1960) Jan.

Male, weanling rats were exposed to 500 r of whole-body x irradiation and then fasted. Control rats were concurrently fasted. Ketonemia, ketonuria, hepatic glycogen, ketogenesis by liver slices, and fatty acid oxidase activity of liver mitochondria were measured. A radiation-induced decrease in fasting ketonemia was observed. This decrease was mainly in the β-hydroxybutyric acid fraction. Ketonuria was similar in both control and irradiated lots the 1st postirradiation day and lower in the irradiated lot during the 2nd day. Decreased ketonemia in the irradiated rats, which exhibited diuresis, was thus apparently not due to increased urinary excretion of ketone bodies. Ketogenesis by liver slices from irradiated rats was depressed. This indicated than an antiketogenic process contributed to the radiation-induced decrease in fasting ketonemia. Fatty acid oxidase activity of liver mitochondria isolated from control and irradiated rats was similar. Thus, rate-limiting fatty acid oxidizing enzymes were not altered by radiation under these conditions. This illustrates an apparent modifying effect of other cellular fractions on fatty acid oxidation in mitochondria. (auth)

7226

THE TISSUE DOSE FROM NEUTRON IRRADIATION. A. M. Kogan, G. G. Petrov, L. A. Chudov, and P. A. Yampolskiĭ. Atomnaya Energ. 7, 351-62(1959) Oct. (In Russian)

The dosimetric characteristics of intermediate energy neutrons are analyzed. Neutron interactions with paraffin at 100 ev to 1 Mev are computed, and the results are applied in estimating the components of tissue dose in the slowing process. The neutron capture dose is calculated using published data on slow neutron distribution in paraffin and on neutron reflection from hydrogen-containing media. The depth distributions are found for neutrons of thermal, 100 ev, 1, 30, 240, and 500 kev, and 1 Mev energies. Biological dose distributions and magnitudes per neutron were determined. (tr-auth)

7227

SOME EFFECTS OF ROENTGEN RAYS (220 KVP) AND GAMMA RAYS (COBALT-60) ON CHICKEN EGGS. M. K. Loken, A. A. Beisang, D. G. Mosser, and J. F. Marvin (Univ. of Minnesota Hospitals, Minneapolis). Atompraxis 5, 469-72(1959). (In English)

The third and eighteenth day of development of the chick embryo appear to be the times when death is most likely to occur. This is true for both irradiated and unirradiated embryos. Hemmorrhage does not appear to be a significant cause of death of irradiated embryos. Absorption of embryos that died during the first day of incubation is completed on or before the fifth day of incubation. Embryos surviving radiation treatment appear to develop at a normal rate. After the fifth day of low temperature storage, the viability of embryos decreases. The irradiation of the embryos prior to low temperature storage does not change the appearance of the viability curve. Irradiation of chicken embryos in the early gastrula stage does not increase the number or type of gross abnormalities. Chickens that hatch from both irradiated and unirradiated eggs do not exhibit apparent differences in growth rate. Both are able to carry out the normal life functions including reproduction. No differences are apparent in the offspring (second and third generations) of the chickens hatched from irradiated and unirradiated eggs. (auth)

7228

RADIOINDUCED MUTATIONS AND PLANT BREEDING. F. Scholz (Deutsche Akademie der Wissenschaften, Berlin). Atompraxis 5, 475-81(1959). (In German)

By means of experimental induction of mutations using ionizing radiations valuable new forms of agricultural and horticultural plants as well as of micro-organisms used for industrial purposes can be produced. This has been proved by a great number of investigations performed in many countries. "Mutation-breeding" has been evolved to a new method of plant breeding. However this is not in contradiction to the fact that ionizing radiations are extremely dangerous and injurious for all living creatures in physiological genetic respects. For the plant breeder however there is the chance of radically rejecting all inopportune forms and of using the rare valuable mutants only. A survey on results, potentialities, and problems of mutation research in the applied field is given. 82 references. (auth)

7229

AN ELECTROPHYSIOLOGICAL ANALYSIS OF HOW NON-IMPULSIVE EFFECTS SPREAD ALONG NEUROMUSCULAR STRUCTURES FROM X-IRRADIATED AREAS. M. G. Pshennikova (Lomonosov State Univ., Moscow). Biophysics (U.S.S.R.) (English Translation) 3, 645-51(1958).

X rays caused a rise in excitability that lasted for not less than 4 to 5 hr in distal areas of the nerve when they were allowed to act on 8 to 9 mm lengths of frog sciatic nerve. The action potential spikes from the nerve were heightened, whether the stimuli to the distal areas were threshold, medium, or strong. This rise in excitability in distal areas went with two phases of change in the action potentials of grastrocnemius muscle, if the muscle potentials were recorded when the nerve was stimulated in distal areas. The muscle potentials at first rose and then fell. The contractile responses also showed two phases that ran parallel; some effect spread from the irradiated area to the muscle itself. (auth)

7230

SOME REGULARITIES IN THE POST-IRRADIATION CHANGES IN RESTING YEAST CELLS. V. I. Korogodin (Lomonosov State Univ., Moscow). Biophysics (U.S.S.R.) (English Translation) 3, 663-8(1958).

It has been shown how the spontaneous lysis rate, neutral dye uptake and damage are affected for yeast cells that have been irradiated with γ rays and have then been kept on a non-nutritive medium. The times at which irradiated resting cells died did not differ essentially from those for controls when the radiation doses were only part-lethal. Absolutely lethal doses caused part of the cells to die and lyse rapidly; the fraction of the cells that did this was about equal to the fraction that is inactivated without division. It is very probable that the processes that cause cells to be inactivated after a few division cycles cannot proceed far or at all if the cells are not metabolically active. Yeast cells recovered if they were kept at rest after γ irradiation. The laws of such recovery may serve as one means of elucidating the nature of the primary damage. (auth)

7231

CHANGES PRODUCED BY GAMMA-RAYS IN THE PHYSICO-CHEMICAL PROPERTIES OF ERYTHROCYTES. Yu. (Iu.) A. Kriger and E. S. Elkhovskaya (Elkhovskaia) (Lomonosov State Univ., Moscow). Biophysics (U.S.S.R.) (English Translation) 3, 668-73(1958).

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 20809.

7232

EFFECTS OF X-RAYS AND EDTA ON CHROMOSOME BREAKS IN TRADESCANTIA PALUDOSA MICROSPORES. N. L. Delaunay (Inst. of Biophysics, Academy of Sciences, Moscow). Biophysics (U.S.S.R.) (English Translation) 3, 673-80(1958).

EDTA caused chromosome crossovers when used at a suitable concentration. The changes produced by EDTA and x rays acting together were not additive. Chromatid and semichromatid crossovers occurred when the two acted together at interphase; the nature and the number of crossovers altered. This indicates that the EDTA increased the time during which broken chromosomes could join up. The new types of crossover that resulted from the joint action must mean that the types of mutations produced must also have altered. (auth)

7233

REGULARITIES IN THE DISTRIBUTION AND TOXICITY OF RADIOELEMENTS. Yu (Iu.) I. Moskalev. Biophysics (U.S.S.R.) (English Translation) 3, 680-5(1958).

Some regularities in the distributions and biological effects of radioisotopes are discussed. The elements in any one group of the periodic system behave very similarly. The types of distribution distinguished are the skeletal, the liver, the uniform, and the kidney. Complexing agents, carriers, and pH alter the distribution types found with elements having hydrolyzable compounds; they produce no effects with elements giving mostly soluble compounds. Toxicities should not be evaluated in terms of activity alone, since the radiation dose is the primary parameter, and not the decay rate. The effectiveness of any emitter depends on its physical parameters and on its physiological behavior. (auth)

7234

IN VIVO GLYCOGENESIS IN X-IRRADIATED RATS. M. K. Nerurkar and M. B. Sahasrabudhe (Atomic Energy Establishment, Trombay, India and Indian Cancer Research Centre, Bombay). Brit. J. Exptl. Pathol. 40, 318-23(1959) Aug.

Studies on the levels of total glycogen in fasted and fed normal animals and in fasted irradiated rats indicate that total-body x irradiation of 600 r increases the hepatic glycogen in fasted rats and that this accumulation of liver glycogen is due to increased synthetic activity rather than due to a block in the breakdown of glycogen. Measurement of free and bound fractions of glycogen in liver and muscle of control and x-irradiated rats indicate that x irradiation produces a uniform rise in both the fractions. The data obtained with the in vivo glycogenesis suggest that the metabolic processes involved in the formation of glycogen from glucose are augmented as a result of irradiation exposure. (auth)

7235

THE EFFECT OF WHOLE-BODY RADIATION ON AUTOLOGOUS SKIN TRANSPLANTS. Milton Elkin and Daniel Salvioni (Yeshiva Univ., New York and Bronx Municipal Hospital Center, N. Y.). Brit. J. Radiol. 33, 28-31(1960) Jan.

Split-thickness grafts have been taken in the rabbit, with subsequent cross-transplantation of 18 grafts per animal. The outcome of the grafts has been evaluated by gross inspection as well as biopsy. A single dose of 100 r of whole-body radiation does not interfere with immediate autologous grafting, 91 per cent takes as compared to 92 per cent in the controls. Doses of 300 and 500 r significantly diminish the percentage of takes, 67 and 63 per cent. Delay in performing the grafts after the radiation improves the results, 85 per cent with a seven-day wait and 89 per cent with a 14-day wait as compared to the 67 per cent of 300 r with immediate grafting. Cysteine given intravenously before a dose of 300 r restores to the con-

trol level the percentage of takes of immediate grafts. (auth)

7236

THE ALTERATION IN RADIOSENSITIVITY OF THE INTACT MOUSE SPLEEN BY EXTREME HYPOTHERMIA. L. Weiss (National Inst. for Medical Research, London). Brit. J. Radiol. 33, 32-5(1960) Jan.

The effect of 800 r of whole-body irradiation on the intact mouse spleen in the normal, hypothermic (1°C), and AET-protected animal is described. Both hypothermia and AET protect the spleen and the degree of protection is of the same order as assessed by spleen weights and histology five days after exposure. (auth)

7237

A 10 CURIE STRONTIUM 90 BETA-RAY THERAPY UNIT. J. L. Haybittle (Addenbrooke's Hospital, Cambridge, Eng.). Brit. J. Radiol. 33, 52-4(1960) Jan.

A 10-curie strontium 90 β-ray therapy unit is described, capable of treating areas up to 40 × 20 cm at 40 cm S.S.D. with a dose-rate of 47 rads/minute. Smaller areas at shorter S.S.D.'s can be treated with correspondingly higher dose-rates. The half-value depth of the radiation is about 2.5 mm in tissue. (auth)

7238

A CODE OF PRACTICE FOR X-RAY MEASUREMENTS. Brit. J. Radiol. 33, 55-9(1960) Jan.

A code is presented for use in measurements of radiation having a half-value thickness in the range 0.5 to 5 mm Cu. (C.H.)

7239

THE EFFECT OF IONIZING RADIATION ON THE MICROFLORA AND THE COURSE OF THE WOUND PROCESS IN EXPERIMENTALLY INDUCED INFECTED WOUNDS. A. A. Vodyannikova (Sverdlovsk Scientific Research Inst. of Restorative Surgery, Traumatology and Orthopedics, USSR). Byull. Eksptl'. Biol. Med. 48, No. 7, 34-8(1959) July. (In Russian)

Experiments conducted on white rats and mice demonstrated that x-ray irradiation of the animals with local purulent focus caused an acute depression of phagocytosis and pronounced increase of the number of microbes in the wound with increase of their pathogenic properties. This promotes the generalization of the process bacteremia and causes the death of the animals. (auth)

7240

THE EFFECT OF VARIOUS DOSES OF PENETRATING RADIATION ON THE ANTIGENIC AND BIOLOGICAL PROPERTIES OF BROWN-PEARCE CARCINOMA IN VITRO. REPORT I. ON THE CHANGES OF THE ANTIGENIC PROPERTIES. I. N. Maiskii, G. V. Suvorova, and P. P. Filatov (Inst. of Experimental Biology, Academy of Medical Sciences, Moscow). Byull. Eksptl'. Biol. Med. 48, No. 7, 72-6(1959) July. (In Russian)

The effect of penetrating radiation (particularly of x rays) on the antigenic structure of the Brown-Pearce carcinoma cells and the establishment of a relationship between the irradiation doses and the changes in the antigenic structure of the tumor tissue were studied. The data show that x rays produce a change in the antigenic structure of the Brown-Pearce carcinoma which varies with on the irradiation dose (2,000, 5,000, 10,000, and 20,000 r). The higher the irradiation dose the greater the changes of the antigenic structure of the irradiated tumor tissue. (auth)

7241

THE EFFECT OF IONIZING RADIATION OF VARIOUS INTENSITY ON REGENERATIVE PROCESS IN THE BONE TISSUE. E. M. Pilshchik (Pavlov Leningrad Medical Inst.) Byull. Eksptl'. Biol. Med. 48, No. 7, 90-5(1959) July. (In Russian)

Single Co^{60} γ irradiation of white rats in doses of 1,000 and 1,500 r caused a distinct depression of regeneration following trepanation of the femur (the medial third of its diaphysis) by means of a dental drill N. 3 (on the 7th to 14th day after the operation). Retarted bone formation could be also observed with the injury of the bone inflicted 3 months after the irradiation (1,000 r). In experiments with chronic irradiation lasting 12 days (the sum total doses being 1,000 and 1,500 r), the efficacy of the radiation action on the bone tissue would not diminish after 2 to 3 months and at times appear to be even somewhat higher. In chronic irradiation the bone marrow tissue showed only slight injuries, but became acutely disturbed following single irradiation. Its structure, however, was rapidly restored. (auth)

7242

PROTECTIVE EFFECTS OF ASCORBIC ACID WITH RESPECT TO IRRADIATION OF TISSUES OF THE CROWN-GALL OF VIPER'S GRASS BY X RAYS. Robert Jonard. Compt. rend. 250, 185-7(1960) Jan. 4. (In French)

Colonies of tissues of crown-gall of viper's grass (Scorzonera hispanica) cultivated for three successive transitions on a medium with and without ascorbic acid additions to a concentration of 10^{-5} were used in the study. Doses of x rays at 500, 1000, 1500, and 2000 r were given. The colonies with ascorbic acid showed a smaller growth inhibition than those without, thus showing that the ascorbic acid exerts a radioprotective effect. (T.R.H.)

7243

EFFECTS OF X IRRADIATION ON ALLERGIC SKIN LESIONS OF THE DELAYED TYPE. H. Ramioul and J. Lecomte (Université, Liège). Compt. rend. soc. biol. 153, 1485-7(1959). (In French)

Patients with skin diseases requiring radiotherapy and showing a tuberculin reaction were studied. In six, an intradermal tuberculin injection was followed by 1000 or 2000 r of irradiation. Thirty had already been irradiated and were given tuberculin injections 49 hours later in the irradiated zone and in an unirradiated zone as control. Five others had received prolonged radiotherapy for mammary neoplasms and were tuberculin injected in irradiated and unirradiated areas. For small doses applied locally, x rays increased the intensity of delayed allergic papules due to tuberculin. Larger doses spread out over a long period of time completely inhibited the different reactions. (T.R.H.)

7244

EFFECT OF IODOACETIC ACID ON THE TOTAL EXCRETION OF SODIUM AND POTASSIUM IN RATS EXPOSED TO X-RAYS. M. Boccacci and M. Quintiliani (Istituto Superiore di Sanita, Rome). Experientia 16, 31-2 (1960).

Iodoacetic acid plus irradiations were found to increase the excretion of sodium in rats considerably over the case when the rats were irradiated only. The excretion of potassium did not appear to be modified by the additional treatment of iodoacetic acid plus radiations. (C.J.G.)

7245

A REVIEW OF SOVIET RESEARCH ON THE CENTRAL NERVOUS SYSTEM EFFECTS OF IONIZING RADIATIONS. Walter R. Stahl (Science Research Inst., Oregon State

Coll., Corvallis). J. Nervous Mental Disease 129, 511-29 (1959) Dec.

Brief reviews are presented of a number of untranslated Russian research papers on the effects of radiation on the central nervous system. (C.H.)

7246

THE EVALUATION OF THE INTEGRAL ABSORBED DOSE IN DIAGNOSTIC ROENTGENOLOGY. K. Reinsma (N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands). Medicamundi 5, 41-6(1959). (In English)

Methods are discussed for determining the integral absorbed dose during each diagnostic investigation. The integral absorbed dose is the total energy imparted to the patient. For the radiation qualities used in diagnostic procedures nearly all the energy of the x-ray beam is absorbed by the patient. This energy is the product of the intensity, the cross sectional area of the beam and the exposure time. This has led to the designing of an instrument, comprising a flat ionization chamber placed between diaphragm and patient, which is large enough to cover the widest field. The current from the ionization chamber is fed into an integrating electrometer. Special measures have been adopted to take into account the fact that a wide range of radiation qualities are used in diagnostic radiology. Results obtained in clinical application are reported. (auth)

7247

AN ALTERNATIVE MECHANISM FOR CHEMICAL PROTECTION AGAINST RADIATION DAMAGE. Mark M. Jones (Vanderbilt Univ., Nashville). Nature 185, 96-7 (1960) Jan. 9.

Reaction mechanisms involved in the radioprotective effect of chelating agents are discussed. It is suggested that the catalytic effectiveness of chelate complexes in decomposing hydroxylonium or hydrogen peroxide is the basis of their action. The possibility is considered that two or more major types of radiation damage may be cumulative to produce a lethal effect. The control or elimination of one of these types may reduce the cumulative damage to a level which is not lethal. (C.H.)

7248

RADIATION CARCINOGENESIS: A NEW HYPOTHESIS. P. R. J. Burch (Univ. of Leeds, Eng.). Nature 185, 135-42 (1960) Jan. 16.

Human radiogenic leukemia and bone cancer are discussed and arguments are advanced in support of the tentative view that both diseases are initiated by a highly specific two-hit mechanism. (C.H.)

7249

CONDITIONED AVOIDANCE BEHAVIOUR INDUCED BY LOW-DOSE EXPOSURE. John Garcia and Donald J. Kimeldorf (U. S. Naval Radiological Defense Lab., San Francisco). Nature 185, 261-2(1960) Jan. 23.

It was found that fast neutrons can be employed as an unconditioned stimulus to produce avoidance behavior by rats. Neutron exposures of a few minutes resulted in conditioning which required several hours exposure to x or gamma radiation to achieve. (C.H.)

7250

ESTIMATION OF THE CELLULAR LETHAL DOSE AND THE CRITICAL CELL NUMBER FOR THE C3H MOUSE MAMMARY CARCINOMA FROM RADIOSENSITIVITY STUDIES IN VIVO. A. Cohen and L. Cohen (Johannesburg Hospital). Nature 185, 262-3(1960) Jan. 23.

Data are tabulated from the results of a series of experiments on the radiosensitivity of mouse mammary carcinoma under various conditions. The data are based on 799 individual treatments. Estimates are made of the cellular lethal radiation dose and the critical cell number for mouse carcinoma. (C.H.)

7251

THE INFLUENCE OF NUTRITION ON MUTATION INDUCED BY RADIATION. SIXTH DOUGLAS LEA MEMORIAL LECTURE. D. G. Catcheside (Univ. of Birmingham, Eng.). Phys. in Med. Biol. 4, 117-25(1959) Oct.

Evidence is presented which suggests that nucleic acid precursors, arising from purines and pyrimidines and their ribosides, are altered or activated by irradiation. For mutation to occur, these altered precursors must be incorporated into the hereditary nucleic acid and preservation for this incorporation is dependent upon synthesis of protein immediately following radiation exposure. The altered precursors decay rather rapidly after irradiation unless they are protected by amino acids. The effects of nutritional state and other factors which may also affect nucleic acid synthesis are discussed. (C.H.)

7252

THE EFFECTS OF RADIOACTIVE PHOSPHORUS (P^{32}) ON SPONTANEOUS MAMMARY TUMOURS IN MICE. E. Ya. Smoilovskaya (Ia. Smoilovskaia) (Academy of Medical Sciences of the U.S.S.R.). Problems of Oncol. (U.S.S.R.) (English Translation) 5, No. 2, 110-12(1959) Dec.

Results are reported from an investigation of the effects of radioactive phosphorus on spontaneous mammary cancer in mice. Results are compared with the distribution of phosphorus-32 in the tumor and internal organs. (C.H.)

7253

DEVELOPMENT OF OVARIAN TUMOURS IN RATS AFTER X-IRRADIATION. E. A. Ird (Inst. of Experimental Pathology and Therapy of Cancer, Academy of Medical Sciences, USSR). Problems of Oncol. (U.S.S.R.) (English Translation) 4, 560-2(1958).

As a result of x irradiation of the ovaries of rats of uncertain lineage, tumors developed with different histological structures—theca cell luteoma, granulosa cell, and mixed types. Ovarian tumors only developed when the dose of x rays was 300 r or over. The most effective dose at which the highest percentage of tumors was observed was 1000 r. With a single-dose x irradiation the higher the dose the shorter the period before the appearance of the first tumor and the higher the frequency of tumor formation. (auth)

7254

DISCUSSION ON THE CHANGES PRODUCED IN TISSUES BY IRRADIATION. [I]. COMPLICATIONS FOLLOWING RADIOTHERAPY OF THE THORAX AND ABDOMEN. H. J. G. Bloom ([Royal Marsden Hospital], London). Proc. Roy. Soc. Med. 52, 495-500(1959) July.

A variety of sequelae that may follow supervoltage radiotherapy of the thorax and abdomen is described. It is emphasized that complications amounting to serious injury are rarely seen at the present time where irradiation is carefully carried out by those experienced in this field of treatment. On the other hand, with the increasing use of supervoltage therapy we can expect to see an increase in the number of injuries to internal organs, especially where radical treatment is pursued in an effort to eradicate highly malignant and relatively radioresistant tumors. In such cases a certain number of injuries will probably have to be accepted as the price of treatment aimed at saving lives otherwise doomed. Careful planning of therapy, regular observation during treatment, and consideration given to the dose to be delivered in the light of the volume of tissue and type of tumor being treated

will reduce serious injuries to a minimum. In addition, a close co-operation between pathologist and radiotherapist in the study of these changes will do much to keep the clinician alert to the dangers of over-dosage. (auth)

7255

DISCUSSION OF THE CHANGES PRODUCED IN TISSUES BY IRRADIATION. [II]. CHANGES PRODUCED IN TISSUES BY IRRADIATION. A. Glucksmann ([Strangeways Research Lab], Cambridge, Eng.). Proc. Roy. Soc. Med. 52, 500-4(1959) July.

Histological changes are described which were observed in embryonic rat retina, salivary glands of adult rats, and the skin of adult rats following exposure to various doses of x radiation. Factors affecting the radiosensitivity of tissues are discussed. It is concluded that one of the most striking and least understood effects of irradiation on tissues is the damage to the mechanism controlling the integration of cells into tissues and organs capable of orderly and simultaneous functions. It is pointed out that radiation transforms homogeneous glands into a chaotic, uncoördinated collection of cells and acini functioning haphazardly and unequally. Similarity of this loss of regulatory control with the induction of tumors is discussed. (C.H.)

7256

EFFECT OF RADIATION ON DISTRIBUTION OF S^{35}-LABELED SULFONAMIDE. Mary F. Argus, Judith F. Kane, and Francis E. Ray (Univ. of Florida, Gainesville). Proc. Soc. Exptl. Biol. Med. 103, 87-91(1960) Jan.

Male and female Wistar rats and CAF_1/Jax mice were found to show a reduction in weight of thymus and spleen 48 hours following whole-body irradiation of 150 r. Unlike the presence of a tumor in an animal body, this irradiation dose did not affect uptake of fluorene-2,7-di-(sulfonamido-2-naphthalene)-S^{35} by liver and spleen. Significantly different localization of the S^{35}-labeled compound was found in blood cells and thymus of irradiated as compared to nonirradiated male mice. (auth)

7257

CHANGES IN THE RADIATION SENSITIVITY OF SOME ENZYMES AND THE POSSIBILITY OF PROTECTION AGAINST THE DIRECT ACTION OF IONIZING PARTICLES. Reinier Braams (Yale Univ., New Haven). Radiation Research 12, 113-19(1960) Feb.

The variation of the sensitivity for inactivation by ionizing radiation of vacuum-dried invertase was investigated. It was found that different purification methods lead to different radiation sensitivities. In some preparations the addition of cysteine, glutathione, or yeast extract can lead to a reduced sensitivity. A possible mechanism for this protection effect is discussed. (auth)

7258

EFFECT OF X-RADIATION ON DNA METABOLISM IN VARIOUS TISSUES OF THE RAT. II. RECOVERY AFTER SUBLETHAL DOSES OF IRRADIATION. Oddvar F. Nygaard and Richard L. Potter (Univ. of Michigan, Ann Arbor). Radiation Research 12, 120-30(1960) Feb.

The effect of 100 and 400 r of total-body x irradiation on DNA synthesis in thymus, spleen, and small intestine of the rat has been studied over extended periods. The incorporation of thymidine-2-C^{14} into DNA during 1 hour was used as a relative measure of DNA synthesis. Following an initial period of inhibition the tissues recovered their ability to synthesize DNA. The time for this recovery depended on the tissue and on the radiation dose. In terms of specific activity of the isolated DNA, i.e., the relative rate of DNA synthesis, the maximum rate of recovery after 100 r for small intestine, spleen, and thymus was at 2, 2, and 3 days, respectively. After 400 r the maximum specific activities were observed at 2, 6, and 4 days for the same tissues, the spleen in this case recovering later than the thymus. Since there was an extensive initial loss of DNA from the irradiated organs, the recovery in terms of total activity of the DNA was less pronounced than that of the specific activity. In all cases the specific activity exceeded the control value at the time of maximum recovery, usually by a factor of approximately 2. For thymus after 400 r this overshoot was ten times as great as the control value, indicating an extremely active regeneration. It has been concluded that the effect of radiation on the DNA metabolism of the three tissues studied can be considered qualitatively the same, differing only in the degree of acute cell death, in the duration of the delay of DNA synthesis in the surviving cells, and in the rate of recovery resulting from accelerated cell replication during the period of regeneration. (auth)

7259

EFFECT OF X-RADIATION ON DNA METABOLISM IN VARIOUS TISSUES OF THE RAT. III. RETENTION OF LABELED DNA IN NORMAL AND IRRADIATED ANIMALS. Oddvar F. Nygaard and Richard L. Potter (Univ. of Michigan, Ann Arbor). Radiation Research 12, 131-45(1960) Feb.

The retention of DNA previously labeled with thymidine-2-C^{14} in vivo has been studied in normal and in irradiated rats. From the results obtained in the normal rats average turnover times have been calculated for the more active cells in thymus, spleen, bone marrow, and small intestine. The data also provided a rough estimate of the migration time of the epithelial cells in the small intestine. The irradiated rats were given 100 or 400 r at 3 or at 24 hours after the injection of radioactive precursor. The specific activity of the DNA retained in the different organs indicated that the labeled and unlabeled cells were lost in an essentially random manner. This suggests that, with respect to the loss of cells from these organs, the dividing and nondividing cells are, on the average, equally sensitive to radiation. There was, furthermore, no indication of cyclic changes in this sensitivity, nor did the cell loss appear to relate to any specific time of the division cycle. (auth)

7260

INCIDENCE OF MORTALITY AND DOSE-RESPONSE RELATIONSHIP FOLLOWING PARTIAL-BODY X-IRRADIATION OF THE RAT. A. Dunjic, J. Maisin, P. Maldague, and H. Maisin (Univ. of Louvain, Belg.). Radiation Research 12, 155-66(1960) Feb.

The incidence of mortality and dose-response relationship for the early and late deaths following irradiation of the head, thorax, and abdomen of rats exposed to single doses of x rays are given. The radiosensitivity of different biological systems involved after partial-body irradiation is compared. The implications of the mortality data following partial-body irradiation for the interpretation of the shortening of life span after whole-body irradiation are discussed. (auth)

7261

SURVIVAL TIME FOLLOWING MASSIVE FRACTIONATED IRRADIATION. Howard L. Andrews (National Cancer Inst., Bethesda, Md.). Radiation Research 12, 195-201(1960) Feb.

Mice, rats, hamsters, and guinea pigs have been subjected to supralethal doses of x rays, delivered in two equal doses separated by a variable time interval. Survival time has been studied as a function of interval between doses, for a constant total dose in each species. In

general, fractionation reduced the effect of a given dose on survival time, although the pattern varies with the species. The reduced effectiveness is partly due to repair processes and partly to radiation wasted because it is absorbed by already doomed tissues. (auth)

7262

THE RELATIVE BIOLOGICAL EFFECTIVENESS OF COBALT-60 GAMMA RAYS AND 220-Kvp X-RAYS ON THE VIABILITY OF CHICKEN EGGS. Merle K. Loken, Arthur A. Beisang, Eugene A. Johnson, and Donn G. Moser (Univ. of Minnesota, Minneapolis). Radiation Research 12, 202-9(1960) Feb.

The relative biological effectiveness of cobalt-60 γ rays and 220-kvp x rays on the viability of fertile chicken eggs has been determined. The RBE with 95% confidence interval was found to be 0.82 ± 0.06 when the absorbed dose was measured at the position of the embryo. On the basis of absorbed dose rate determined at the center of the egg, the RBE was found to be 0.80 ± 0.06. The relative biological effectiveness was found to be independent of dosage in the range from 330 to 1030 rads. The LD_{50}'s for cobalt-60 γ rays and 220-kvp x rays were found to be 705 ± 21 and 583 ± 17 rads, respectively. These values were determined from measurements of absorbed dose at the position of the embryo. (auth)

7263

BIOLOGIC EFFECTS OF RADIATION AND A DISCUSSION OF RADIOLOGICAL UNITS. Titus C. Evans. Trans. Am. Acad. Ophthalmol. Otolaryngol. 63, 433-8(1959) July-Aug.

Biological effects of radiation are discussed with emphasis on effects on cells of the eye. Units of radiation exposure are defined, and the interactions of radiation with matter are reviewed. Variations in radiosensitivity of cells and means of modifying radiosensitivity are discussed. (C.H.)

7264

OCULAR THERAPY WITH BETA PARTICLES. James E. McDonald (Univ. of Illinois Coll. of Medicine, Chicago) and Fred M. Wilson (Indiana Univ. Medical Center, Indianapolis). Trans. Am. Acad. Ophthalmol. Otolaryngol. 63, 468-85(1959) July-Aug.

Beta radiation ophthalmic applicators, especially those with radioactive Sr^{90}, provide a ready source of radiotherapy for superficial lesions of the eye. A survey of 694 beta-radiated eyes is reported. The results of this survey indicate that these beta particles produce effects on ocular tissue which are more or less predictable in incidence and latency. These effects, both the desirable and the undesirable ones, are discussed and attempts are made to define the latent period, dose of production, incidence, and clinical course of these effects. This type of therapy is effective in treating corneal vascularization, especially that occurring in rosacea keratitis. It is of value as an adjunct to surgical procedures in the treatment of recurrent pterygiums. It is especially indicated in limbal tumors with or without associated surgical excision. It seems to have some use in inflammation and allergic conditions of the cornea and also in certain lid conditions. It is associated with complications such as lens opacities, postradiation vessels, interference with wound healing, and others. (auth)

7265

RADIOTHERAPY COMPARED TO OTHER FORMS OF OCULAR THERAPY. William F. Hughes (Univ. of Illinois Coll. of Medicine, Chicago). Trans. Am. Acad. Ophthalmol. Otolaryngol. 63, 486-96(1959) July-Aug.

With increasing knowledge of the tolerance of ocular tissues for radiation, the radiotherapy of ocular lesions may be undertaken without undue damage to the normal tissues. It is stressed that radiotherapy of eye lesions should be reserved for those conditions in which it is definitely superior to other methods of treatment, or in which other methods of treatment have failed, especially in the radiotherapy of nonmalignant lesions. (C.H.)

7266

EFFECT OF IONIZING RADIATION ON THE LIPID COMPOSITION OF THE BLOOD AND LIVER IN RATS. V. V. Nikolskii (Nikolsky), N. A. Nekovalyeva, and L. M. Chumakova (Rostov and Donu Medical Inst., USSR). Ukrain. Biokhim. Zhur. 31, 877-82(1959). (In Ukrainian)

Preliminary experiments have shown that a tendency towards an increase in the non-saturation of fatty acids and in the blood cholesterine level arises in rats that have received a lethal dose of ionizing radiation. At the same time, the non-saturation of liver lipids as compared to that in intact animals shows a much wider range of fluctuations in both directions. The same irradiation of rats kept on a fatless diet leads to a decrease in the non-saturation of fatty acids of the blood and to a rise in the total fatty acid content of the liver, while the level of non-saturation of lipids remained low in this organ. (auth)

7267

RADIOINDUCED DEVELOPMENT DISTURBANCES IN RABBIT EMBRYOS. K.-H. Degenhardt and H. J. Grüter (Westfälische Wilhelms-Universität, Munster, Ger.). Z. Naturforsch. 14b, 753-6(1959) Dec. (In German)

A phase-specific effect in early embryo development is reported. Single x irradiations (skin doses of 250 r) of pregnant shielded rabbit uterus in the disturbance-sensitive phase of early spinal column development (8th or 10th day of embryonic development), as defined by oxygen-deficiency experiments, resulted in a preferential damaging of the axial skeletal systems as a function of different induction processes for forming the spinal column, and of the axial gradient decline which is sensitive to cranio-caudal orientation progress. X irradiation showed an important intensive teratogenic effect on early stages of embryo development as attained by oxygen-deficiency influence; this concerns the inhibition of spinal column development as well as injuries to other organ formation. (tr-auth)

7268

EFFECTS OF HIGHER RADIATION DOSES ON THE DORMOUSE. Hans A Künkel (Universität-Frauenklinik, Hamburg-Eppendorf). Z. Naturforsch. 14b, 757-9(1959) Dec. (In German)

After whole-body irradiation of dormice it was shown that the mortality curves for the dose range 1,500 to 10,000 r and beyond have a plateau. Within these constancy regions there is increasing dose without effect on the average survival time (4.2 days). If the irradiation is conducted during hibernation, such a constancy region does not appear. For doses over 6,000 r a few animals died during the hibernating condition. For 10,000 r the damage to the organism is so great that more than half of the animals did not survive a 3-week sleeping period. (tr-auth)

Radiation Sickness

7269

RADIOACTIVE FALL-OUT. III. BIOLOGICAL ACCUMULATION OF RADIOISOTOPES. J. A. G. Davids. Atoomenergie 1, 193-8(1959) Dec. (In Dutch)

In the dispersion of radioactive fall-out to the surroundings, calculations were used to take into consideration biological concentration processes which could result in uptake by man. The problems are caused by a combination of factors, such as quantity and composition of fall-out, physical and chemical properties of the medium, and the nature of the food cycle. (tr-auth)

7270

THE ROLE OF VERTICAL TURBULENT DISPERSION IN THE SETTLING OF NON-HOMOGENEOUS AEROSOL FROM THE ATMOSPHERE. A. Ya Pressman (Inst. of Applied Geophysics, Academy of Sciences, Moscow). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. No. 11, 11-19(1959) Nov. (In Russian)

By comparing two effects causing the vertical dispersion of particles of aerosol of non-homogeneous composition settling from the atmosphere—the effect of vertical turbulent diffusion and the effect of the difference in the velocity with which the particles settle—criteria are obtained by the use of which the effect of vertical turbulence in the settling of non-homogeneous aerosols from the atmosphere may be neglected with determined error. (auth)

7271

RADIOACTIVE FISSION PRODUCTS IN LUNGS. T. Schönfeld, K. Liebscher, F. Karl, and Christina Friedmann (Univ. of Vienna). Nature 185, 192-3(1960) Jan. 16.

Gamma-scintillation spectra of dust samples collected and measured in Vienna since July 1958 showed the presence of cerium-141, cerium-144, ruthenium-103, zirconium-95, and niobium-95. Lungs from animals and humans were ashed and the gamma spectra of the ashes measured. Fission products detected in dust were also found in lung tissue. Data are tabulated. (C.H.)

7272

YEARLY VARIATION IN STRATOSPHERIC FALLOUT COMPOSITION. G. Schumann and G. Eulitz (Universität, Heidelberg, Ger.). Naturwissenschaften 47, 13-14(1960) Jan. (In German)

Strontium-90 activity and total fission-product activity of the atmosphere at Heidelberg are plotted for the period January 10, 1957, to early 1959 and discussed. (T.R.H.)

7273

QUESTIONS OF THE MORPHOGENESIS OF OSTEOGENIC SARCOMATA FORMING AFTER INTRAPERITONEAL INTRODUCTION OF Sr^{90}. L. A. Cherkasskii (Central Scientific Research Inst. of Medical Radiology, USSR). Problems of Oncol. (U.S.S.R.) (English Translation) 5, No. 2, 18-30(1959) Dec.

The morphogenesis of bone sarcoma is described as observed in rats following the injection of strontium-90. (C.H.)

7274

PROTECTIVE EFFECTS ON FECUNDITY AND FERTILITY FROM FEEDING CYSTEINE AND GLUTATHIONE TO HABROBRACON FEMALES BEFORE X-IRRADIATION. Daniel S. Grosch (North Carolina State Coll., Raleigh). Radiation Research 12, 146-54(1960) Feb.

Protective effects on oviposition and egg hatchability were shown for both cysteine and glutathione when fed to female wasps before irradiation. The effect, detected only during a period 3 to 12 days after treatment, was therefore limited to cells in transition from oögonia to differentiated trophocyte-oöcyte units. Transition involves completion of a series of mitotic divisions. Although a direct effect on cell division may be reflected in the number of eggs produced per unit of time, a response deferred until the crises of embryonic development implies alteration in the genetic rather than the kinetic mechanism. Indeed, both the effects on oviposition and egg hatchability could trace back to modifications of chromosomal damage, immediate and delayed. (auth)

7275

FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

On May 5 to 8, 1959, the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, held public hearings on the subject of fall-out from Nuclear Weapons Tests. Volume 2 of the hearings covers a summary of new data on uptake of fission products in milk, food, and human bone; mechanisms of fall-out uptake; recent developments in radiation biology; discussion of permissible exposure levels; the status and implications of nuclear weapons testing; a discussion on surveillance; and a summary of problems and needs for further research. Separate abstracts have been prepared on a number of statements. (C.H.)

7276

STATEMENT ON NEW DATA ON UPTAKE IN MILK, FOOD, AND HUMAN BONE FOR JOINT COMMITTEE HEARINGS ON FALLOUT FROM NUCLEAR WEAPONS, MAY 5–8, 1959. Conrad P. Straub. p.963-1004 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Results of findings from network operations as well as special studies by the Public Health Service at the Robert A. Taft Sanitary Engineering Center were reviewed. The use of environmental radioactivity values in estimating the total intake of strontium-90 is indicated by example. All of the data obtained, however, show the need for more knowledge of the factors affecting retention of strontium-90, particularly the effect of stable strontium and calcium. Since strontium-90 can be found anywhere in the environment, human studies can be carried out in which analyses are made of all food intake as well as all body eliminations. Thus, the objections of added radionuclides to carry out such studies are voided, and measurements are made with the radionuclide in the form in which it is taken into the body rather than in some other form. Extensions of the studies described herein are needed to define areas of higher activity level and permit initiation of the necessary specific control measures before serious dosage or exposure results. (auth)

7277

DETERMINATION OF GROSS RADIOACTIVITY IN WATER, SILT, AND BIOLOGICAL MATERIALS. p.1006-38 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959.

VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Methods are described which were developed for the radiological examination of samples of water, silts, and biological materials for gross radioactivity. (C.H.)

7278

THE DETERMINATION OF GROSS BETA ACTIVITY OF AIRBORNE PARTICULATE MATTER—THIN-WINDOW PROPORTIONAL COUNTING OF WHOLE FILTER SAMPLES. p.1039-44 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Air particulate samples were collected on 8 by 10 inch glass fiber filters by means of a high volume blower. The dust particles were deposited on an area 7 by 9 inches. A large area gas-flow counting chamber and preamplifier was converted to a thin-window counter and connected to a conventional scaler and timer. The filter samples were placed on a sliding tray and centered beneath the chamber for counting. The samples were counted upon receipt and again after 4 to 7 days. Standard sources were used to check the counting efficiency of the instrument. Factors influencing reliability of the data are discussed. (C.H.)

7279

MEASUREMENT OF LOW-LEVEL RADIOACTIVITY IN WATER. Lloyd R. Setter and Abraham S. Goldin. p.1045-60 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.959-1967. (GPO)

A method is described for the measurement of radioactivity in samples of water, sewage, and industrial wastes. (C.H.)

7280

BIOSPHERIC CONTAMINATION FROM NUCLEAR WEAPONS TESTS THROUGH 1958. Wright Langhan and E. C. Anderson. p.1067-1169 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Weapons tests to January 1, 1959, by all nations have produced about 10 megacuries of strontium-90 and 18 megacuries of cesium-137. The total deposited as long range fall-out through January 1959 has amounted to about 4 megacuries of strontium-90 and 7 megacuries of cesium-137. Estimates of the stratospheric reservoir are highly uncertain but indicate a stratospheric content of about 4.5 megacuries of strontium-90 and about 8 megacuries of cesium-137. The production of strontium-90 and cesium-137 has increased by 80% since 1957. The stratospheric reservoir and total surface deposition have increased 100% in the same period, largely due to the U.S.S.R. program. Average surface deposition levels of strontium-90 and cesium-137 as of January 1, 1959, were 57 and 103 mc/mi^2, respectively, for the U. S. For the 20 to 60°N latitude belt the corresponding values were 42 and 72 mc/mi^2. Deposition levels in the north temperate population belt are at least a factor of 2 higher than the world average. The average levels in milk during 1958 were 7.5 $\mu\mu$c strontium-90 per gram of calcium and 50 $\mu\mu$c cesium-137/gK. Strontium-90 levels in human bones have been measured and estimates made of present and future equilibrium levels. The present population weighted strontium-90 content of people of the whole world was calculated as 0.5 $\mu\mu$c/g of calcium, with adults averaging only about 0.19 $\mu\mu$c/g of calcium. Present levels of cesium-137 in people were measured and found to average 67 $\mu\mu$c/g of potassium. People in the United States and in Europe were found to average about the same. Potential hazards of the present strontium-90 and cesium-137 biospheric contamination levels to world health are discussed. (C.H.)

7281

DATA ON THE STRONTIUM-90 CONTENT OF MILK AND OTHER FOODS DURING 1958. John H. Harley, Edward P. Hardy, Jr., Stanley Klein, and S. Allen Lough (Health and Safety Lab., U. S. Atomic Energy Commission, New York). p.1235-57 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Available data are summarized on the strontium-90 content of milk and other foods collected at miscellaneous stations throughout the world during 1958. Studies on the uptake of strontium-90 indicate that the strontium to calcium ratios in the movement from diet to bone are higher for milk diets. Strontium-90 is absorbed less readily from vegetable foods, but some absorption takes place. A comparison is made of the yearly levels of strontium-90 per gram of calcium in milk collected at four U. S. sampling stations during 1957 and 1958. The higher rate during 1958 follows the corresponding high rate of fall-out at the pot sampling stations. The major contribution to the strontium-90 in milk comes from fall-out deposited on vegetation and not from the soil, so is more dependent on fall-out rate than on total deposition. Data are tabulated on the levels of strontium-90 in milk collected throughout the world and wheat grown in Minnesota. (C.H.)

7282

STATEMENT OF DR. C. L. COMAR, CORNELL UNIVERSITY. p.1280-99 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

It is considered that iodine-131, barium-140, strontium-89, strontium-90, and cesium-137 are of primary importance from the standpoint of hazards to the human population from fall-out. Mechanisms by which the important fall-out radiocontaminants move through the food chain to become deposited in the human population are discussed. Data accumulated since 1948 are reviewed on the metabolism, movement, and effects of fission products in farm animals. The half life and metabolic behavior of the radio-

isotopes of interest are reviewed. It is noted that milk is useful for analysis of all the radioisotopes of interest. Factors that determine the importance of each radioisotope in the food chain are discussed. Possible means of reducing dietary intake are mentioned briefly. Physiological processes within the bodies of animals and man that are responsible for the differential behavior of calcium and strontium due to dietary strontium-90 are reviewed. (C.H.)

7283

FALLOUT AND UPTAKE OF IODINE-131. Arthur H. Wolff (U. S. Public Health Service, Washington, D. C. p.1310-13 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Iodine is unique among fission-produced radioisotopes in that it concentrates in the thyroid gland. Consequently, extremely small amounts will result in relatively high dosages to a single gland. As a result of its eight-day half life high concentrations of iodine-131 in the biosphere result primarily from fresh fall-out. Measurements made in various parts of the world on iodine-131 levels in the thyroid glands of grazing animals furnish an index to fresh fall-out. Data indicate average concentrations in cattle and sheep in the United States during 1955 to 1958 were in the order of 700 and 3,000 $\mu\mu c$ per gram of thyroid, respectively. Data are also included on average iodine-131 concentrations in milk collected at a number of stations during the period from 1957 to January 1959. (C.H.)

7284

CONTEMPORARY LEVELS OF CESIUM^{137} IN MAN. p.1314-27 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

The body burden of cesium-137 varies with the body content of potassium and is expressed as the ratio of cesium to potassium in micromicrocuries per group. Since June of 1958, 1100 people were processed at the Walter Reed Army Institute of Research in the human counter for measurement of cesium-137 body burden. A crystal spectrometer was used for selected cases to confirm the presence of cesium-137 and to determine the levels of various gamma emitters in humans resulting from reactor exposures and clinical diagnostic procedures. The human counter is operated as a two-channel analyzer simultaneously determining cesium-137 and naturally occurring potassium-40. Data are tabulated on cesium-137 levels during 1958 of people from the continental United States and front outside the continent. (C.H.)

7285

THE DETERMINATION OF INTERNALLY DEPOSITED RADIOACTIVE ISOTOPES IN THE MARSHALLESE PEOPLE BY EXCRETION ANALYSIS. Kent T. Woodward, Ariel G. Schrodt, James E. Anderson, Harry A. Claypool, and James B. Hartgering (Walter Reed Army Inst. of Research, Washington, D. C.). p.1329-47 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, May 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Following the detonation of a thermonuclear device at the Pacific Test Site on March 1, 1954, 239 Marshallese people were exposed to significant levels of gamma radiation from fall-out. Estimated total exposures ranged from 175r on Rongelap to 14r on Utirik. These populations were evacuated to Kwajalein for decontamination and care. During the two days of fall-out exposure before evacuation was completed, the Marshallese also received some radioactive materials internally by ingestion and inhalation. Estimates of the internal body burden from fall-out were obtained from the analysis of urine samples collected soon after exposure. These data indicated that the acute hazard from internally deposited fission fragments was quite small as compared to the whole body gamma radiation exposure. Although the radioactivity levels in the urine were low, the activity was sufficient to obtain reasonable precision and to warrant additional long term studies of the activity levels and excretion patterns of this rather large and well isolated population. The people from Alinginae and Utirik were returned to their home islands in June 1954. Radiation intensities on Rongelap, however, precluded an early return to this atoll and the Rongelap people lived on Majuro from June 1954 until July 1957. Basic data on the food crops of the Marshallese indicated that after resettlement on the contaminated atolls the intake of Sr^{90} would be increased considerably, and that Cs^{137}, Zn^{65}, and Co^{60} were dietary constituents of island and ocean foodstuffs, and also would be assimilated. The expected increase in the trace amounts of radionucleides in the food supply of a large population would afford an opportunity to investigate the rate of equilibration and the discrimination factors operating between food supply and man. Urinary excretion levels of Cs^{137} and Sr^{90} were measured from March 1954 through March 1958. Zn^{65} levels were first measured in 1958 samples. Data are tabulated. (C.H.)

7286

HUMAN COUNTING FACILITY AT THE WALTER REED ARMY INSTITUTE OF RESEARCH, WALTER REED ARMY MEDICAL CENTER, WASHINGTON, D. C. Kent T. Woodward, Henry A. Claypool, and James B. Hartgering. p.1349-72 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE OF RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

The whole-body radiation counter at Walter Reed Army Medical Center became fully operational on July 14, 1958. From then until March 31, 1959, a total of 1278 persons was measured for levels of cesium-137 and potassium-40. Detailed results of the data obtained are presented in tabular form. (C.H.)

7287

FALLOUT RADIOACTIVITY AND THE DOSE ARISING THEREFROM AT ARGONNE NATIONAL LABORATORY, LEMONT, ILL. APPENDIX TO THE STATEMENT OF DR. AUSTIN M. BRUES. P. F. Gustafson and L. D. Marinelli. p.1400-1 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL

SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES. EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Data are presented on measurements of gamma-ray emitting fission products in soil samples collected at the Argonne National Laboratory site since May 1957. These data indicate the continuing accumulation of cesium-137, which doubled in activity per square mile from October 1957 to September 1958, and doubled again from September 1958 to April 1959. Because of its 26.6-year half life cesium-137 is considered a reliable indicator of the total fall-out accumulated at any given locality. Data are also tabulated on levels of representative fission products in the soil samples. (C.H.)

7288

CRITIQUE OF THE LINEAR THEORY OF CARCINOGENESIS. Austin M. Brues (Argonne National Lab., Lemont, Ill.). p.1402-8 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Present data on human radioinduced carcinogenesis are reviewed. Data on leukemogenesis in the irradiated populations of Hiroshima and Nagasaki and in American radiologists are discussed. It is pointed out that the data fail to indicate a linear relation between dose and effect. (C.H.)

7289

THE DEVELOPMENT OF LEUKAEMIA IN IRRADIATED ANIMALS. R. H. Mole (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.1409-12 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

The pathology of spontaneous and radioinduced leukemia in mice is discussed. The role of the thymus and the relationship of dose rate and leukemogenic mechanisms in radioinduced leukemia are discussed in detail. (C.H.)

7290

LEUKEMOGENIC EFFECTS OF RADIATION. Lloyd W. Law (National Cancer Inst., Bethesda, Md.). p.1421-36 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Present knowledge concerning radioinduced leukemia is reviewed. The question of the justification for extrapolation from one species to another, and particularly to man, is discussed. It is pointed out that since extrapolations must be made it is wise to make them from a species in which meaningful data may be obtained. The striking histologic similarity of neoplasms of the blood and blood-forming organs of the mouse and man is discussed. All types of radiation so far investigated have been shown to be leukemogenic. Data indicate that the initiation of the leukemogenic train of events may follow an instantaneous atomic detonation or to a lesser degree long-continued chronic irradiation. (C.H.)

7291

RADIATION CARCINOGENESIS. Lloyd W. Law (National Cancer Inst., Bethesda, Md.). p.1437-1536 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

The present state of knowledge of radiation carcinogenesis is reviewed. Present concepts concerning radiation injuries and genetic changes induced by radiation are discussed where they relate to carcinogenesis. The relationship of radiation dose to induction of carcinogenesis is considered. The radiosensitivity of skin, bone, hemopoietic, lymphoid, and other tissues is discussed. Evidence is presented for direct and indirect carcinogenic effects of radiation and a latent period in radiation-induced neoplasia. Modifications in the carcinogenetic effects of radiation produced by various agents are described. (C.H.)

7292

EVALUATION OF DATA RELATING HUMAN LEUKEMIA AND IONIZING RADIATION. A. W. Kimball (Oak Ridge National Lab., Tenn.). p.1537-45 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

The statistical reliability of existing data relating human leukemia and ionizing radiation is discussed. It is pointed out that conclusions reached by some observers reveal a confidence in the accuracy of estimated leukemia rates that is difficult to justify. Several sources of error in statistical techniques are outlined in detail, and their effect on the use of certain standard statistical methods is illustrated. The conclusion is reached that available data are insufficient to support any conclusion about the shape of the dose-response curve, particularly in the low-dose region. (C.H.)

7293

MAXIMUM PERMISSIBLE EXPOSURE OF THE POPULATION-AT-LARGE TO SOURCES OF IONIZING RADIATION. Karl Z. Morgan (Oak Ridge National Lab., Tenn.). p.1614-33 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Studies on animals and observations on man indicate that there are two types of radiation damage, one requiring threshold or minimum dose before radiation damage results and the other increasing linearly with the dose. It is

not possible at the present time to state with absolute certainty that human exposure to ionizing radiation is harmful at very low dose rates of the order of natural background. For the present, levels of maximum permissible exposure of the population-at-large to ionizing radiation must be based on estimations involving extrapolations over two to three orders of magnitude below the experimental data that can be considered to be statistically significant. For the present it is assumed that radiation damage, such as genetic mutations, leukemic incidence, and shortening of life span, increase to some extent with any increase in dose taking place at any dose rate following any accumulated dose. It is assumed there is no threshold dose for radiation injuries. It is stated that it is incorrect to assume a linear relationship between dose and effect all the way from high chronic dose rates of 400 rad per 30 years to background dose rates of about 4 rad per 30 years. The thirty year interval is used as a convenient period for considering genetic damage to man since the average fathers and mothers have begotten half their children by this age. The recommended values of maximum permissible exposure to ionizing radiation are made on an international level by the International Commission on Radiation Protection and are made on a national level in the United States by the National Committee on Radiation Protection. The recommendations of both groups are very similar and while they apply primarily to occupational exposure they can be modified to extend to large population groups. (C.H.)

7294

STATEMENT OF DR. JACK SCHUBERT, SENIOR CHEMIST, DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH, ARGONNE NATIONAL LABORATORY. p.1634-47 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Data are reviewed from which it is concluded that radiation doses so low as to approach the radiation levels from fall-out and natural background cause a significant increase in childhood cancer deaths. It is assumed that as the amount of fall-out increases the number of childhood cancer deaths will increase proportionately. It is suggested that the best possible estimates of maximum permissible radiation levels can only be established by a committee of scientists representing all the pertinent fields of science such as genetics, biostatistics, physics, and medicine and members of such a committee should be chosen by an organization such as the National Academy of Sciences. Recommendations for maximum permissible levels of radiation exposure for large populations made by such a committee should be applied to specific situations and occupations such as industry, laboratories, and naval vessels. (C.H.)

7295

BONE TUMOR INTEGRATED DEATH RATES. Harry Auerbach. p.1665-6 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Unless large populations are observed, increases in bone tumor death rates due to environmental or other factors may go undetected. The incidence of tumor deaths resulting from environmental radium or strontium-90 is discussed. Problems involved in the statistical analysis of causes of death in populations are reviewed. Data are tabulated on bone tumor deaths in female populations in the United States from 1949 to 1951 and total deaths and bone tumor deaths in populations of 100,000 followed for 30 years. (C.H.)

7296

A SURVEY OF CHILDHOOD MALIGNANCIES. Alice Stewart, Josefine Webb, and David Hewitt (Oxford Univ.). p.1667-1705 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Results are reported from a statistical survey of deaths from malignancies in children under ten years of age residing in England and Wales during the years 1952 to 1955. Pre-natal and post-natal experiences were compared with those of healthy children. The total number of deaths in the category was 1,694 of which 792 were ascribed to leukemia and 902 to other cancers. Results of the survey were interpreted as indicating a causal relationship between irradiation in utero and childhood malignancies. Topics discussed include the relationship of the incidence of malignancies to x-ray dose, maturity of fetus at the time of exposure, and type and size of malignancy. Tabulated data are included and the methods used in the survey are described. (C.H.)

7297

THE DANGERS FROM FALLOUT OF RADIOACTIVE STRONTIUM AFTER ATOMIC BOMB EXPLOSIONS. Eilif Dahl (Norwegian Agricultural Coll., Aas). p.1706-22 of "FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 2." Washington, D. C., Joint Committee on Atomic Energy, 1959. p.949-1967. (GPO)

Statistical methods used in the preparation of data on fall-out are discussed. It is pointed out that conclusions drawn from American data are often difficult to evaluate. It is concluded that more strontium-90 from fall-out than previously estimated will be taken up by the human organism. The dangers of continued nuclear weapons tests on the health of populations are stressed. (C.H.)

CHEMISTRY

General and Miscellaneous

7298 59USB5931-3(Pt. I)

United States Borax Research Corp., Anaheim, Calif. RESEARCH ON INORGANIC POLYMER SYSTEMS. Quarterly Report [for] period: January 1–March 31, 1959. Apr. 15, 1959. 77p. Project No. 8-(8-7340). Contract AF33(616)-5931.

Progress in investigations of thermally stable inorganic or semi-inorganic polymer systems showing promise of utility at 1000°F is reported. The bonding systems under study include B–B, B–N, and Al–O. The preparation of prototype compounds, investigations of polymerization reactions, and evaluations of thermal stabilities of various monomers and polymers are described. (For preceding period see 58USB5931-2(Pt. 1).) (auth)

7299 AECU-4551

Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

A NEW METHOD FOR PREPARING HYDROXIDE-FREE ALKALI CHLORIDE MELTS. Donald L. Maricle and David N. Hume. [1959]. 8p. Contract AT(30-1)-905. OTS.

Molten salts have been used extensively as solvents for electrochemical processes. The difficulty of removing the last traces of residual moisture from the salts has often necessitated rather arduous drying procedures. If the moisture is not removed, hydrolysis occurs upon fusion. The hydroxide ion thus produced precipitates metal ions, attacks glass, and is reduced more easily than the alkali metals, thus diminishing the usable potential range of the solvent. It was found that if rigorously dried hydrogen chloride is bubbled through the melt for twenty minutes before the argon flush, the hydroxide ion impurity is removed. (W.L.H.)

7300 AFOSR-TN-60-43

Johns Hopkins Univ., Baltimore.

THE SPECTRA OF RARE EARTH IONS. G. H. Dieke. Dec. 31, 1959. 28p. Contract AF49(638)-535.

Progress is reported on rare earth free ion spectra investigations. A discussion of the general background is presented along with a description of techniques used in the work. The experimental phase of praseodymium investigation was completed. The wavelength table was completed on this element, and a partial analysis for Pr IV and Pr III was successful. Shell transitions for Pr IV and Pr III were established for some of the states while more work is required on others. Wavelength measurements were accumulated on neodymium, and progress is reported on interpretations of $NdCl_3$ crystal spectrum. Experimental work on ytterbium was completed, and analysis of Yb IV and Yb III was started. Some preliminary work was completed on thulium, erbium, gadolinium, and other rare earths. Data on crystal levels are included along with diagrams showing energy levels and various spectra. (J.R.D.)

7301 HW-26022

Hanford Works, Richland, Wash.

REPORT OF INVENTION ON THE PREPARATION OF PLUTONIUM TRIFLUORIDE. L. L. Burger and W. E. Roake. Oct. 22, 1952. Decl. Jan. 28, 1960. 3p. OTS.

A method is described for the preparation of PuF_3 by means of a solid phase-gas reaction between Pu(IV) oxalate or Pu(III) oxalate and Freon-type compounds such as CCl_2F_2. (auth)

7302 HW-35815

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CALCIUM URANIUM(IV) FLUORIDE; PRECIPITATION AND REDUCTION TO METAL. W. B. Tolley. Mar. 17, 1955. Decl. Jan. 12, 1960. 14p. Contract W-31-109-Eng-52. OTS.

The double salt calcium uranium(IV) fluoride can be precipitated from uranyl nitrate solution. In the presence of fluoride and calcium ions, ferrous salts will reduce uranium(VI) nitrate to the four state precipitating calcium uranium(IV) fluoride. X-ray studies showed that the compound is a true double salt. The salt can be dehydrated under argon at 250°C and reduced to metal by the bomb technique. Reduction yields are high, but co-precipitated iron in the salt is concentrated in the uranium button, resulting in iron impurities of approximately 0.6%. The double salt is a suitable feed for fused salt electrolysis. Electrolyzing from a solution of 30% double salt dissolved in LiCl-KCl eutectic dendritic uranium was recovered with a current efficiency of 35%. Iron impurity in the electrolyztically prepared uranium was reduced from an expected concentration of 5700 ppm to an actual concentration of 250 ppm. (auth)

7303 IDO-14499

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ZIRCONIUM FLUORIDE PHASE STUDIES. II. SODIUM FLUOZIRCONATE PHASE RELATIONSHIPS. A. J. Moffat. Dec. 31, 1959. 15p. Contract AT(10-1)-205. OTS.

A ternary diagram (H^+, F^-, and Zr) was developed to provide a systematic approach to the preparation and interconversion of three sodium fluozirconates ($2NaF \cdot ZrF_4$, $3NaF \cdot ZrF_4$, and $5NaF \cdot 2ZrF_4 \cdot HF$) in low acid, low fluoride, zirconyl systems. Evidence is presented for the formation of a $ZrOF^+$ ion. (auth)

7304 IS-57

Ames Lab., Ames, Iowa.

THE DETERMINATION OF THE MELTING POINT, THE VAPOR PRESSURE, AND THE DECOMPOSITION TEMPERATURE OF YTTRIUM TRI-IODIDE. D. H. Dennison, F. H. Spedding, and A. H. Daane. Nov. 1959. 16p. Contract W-7405-eng-82. OTS.

Yttrium iodide was prepared by reacting yttrium metal turnings with ammonium iodide. The resulting salt was distilled into a melting point assembly and the melting point and vapor pressure were determined. Decomposition was observed to be less than 5% up to 1650°C. (auth)

7305 LA-2368

Los Alamos Scientific Lab., N. Mex.

A COLLECTION OF MASS SPECTROMETRIC DATA OF SUBSTITUTED BORAZOLES AND THEIR BENZENE ANALOGS. E. Dan Loughran, Charles L. Mader, and William E. McQuistion. Aug. 1959. 35p. Contract W-7405-eng-36. OTS.

The mass spectra and positive ion appearance potentials of borazole, methyl- and chloro-substituted borazoles, and their benzene analogs have been determined. The computed monoisotopic spectra for borazole and for 96% B^{10} borazole are in reasonable agreement. The monoisotopic spectra were also computed for the methyl- and chloro-substituted borazoles. (auth)

7306 NYO-2155

Temple Univ., Philadelphia. Research Inst.

FIRST ANNUAL PROGRESS REPORT. J. G. Floss. Sept. 20, 1958. 24p. Contract AT(30-1)-2082. OTS.

Ways of reducing perrhenates to rhenides as well as the isolation of various metal rhenides and their purification are described. Some physical and chemical properties of rhenides are reported. Alkali metal and barium rhenides are white crystals easily soluble in water and exhibit all of the typical properties of ionic compounds. The pure salts are stable in vacuo or in an inert atmosphere. They are oxidized by air; the rate of oxidation, however, is retarded if the rhenides are contaminated with hydroxides. Results

of earlier work concerning the preparation of a colorless form of ammonium radical in liquid ammonia were not confirmed by current work. This, however, could be attributed to catalytic effects of trace contaminations present. Solutions of ammonium borohydride in liquid ammonia in various concentrations and solid ammonium borohydride were prepared by reacting potassium borohydride and ammonium chloride in liquid ammonia. This compound was synthesized earlier by reacting sodium borohydride with ammonium fluoride in liquid ammonia. Advantages and disadvantages of these two methods are discussed. (auth)

7307 NYO-2216

Pennsylvania State Univ., University Park. Coll. of Chemistry and Physics.

ENTHALPY TITRATIONS IN FUSED SALTS. Progress Report and Request for Contract Renewal. Summary of Progress: January 1, 1959–December 31, 1959. Joseph Jordan. Jan. 15, 1960. 19p. Contract AT(30-1)-2133. OTS.

Enthalpies, entropies, and free energies of precipitation of sparingly soluble halides and chromates were determined in mixed alkali nitrate solvent at 150 to 350°C. Procedures were developed for titrimetric determination of halides, silver, and lead in fused salts in situ. Concentrations of 10^{-4} to 10^{-3} molal were determined with a precision and accuracy of 1%. Proposals of contract renewal for an additional year are presented and an accounting of expenditures under the current contract is given. A list of publications issued during the contract period is also included. (For preceding period see NYO-2214.) (J.R.D.)

7308 WADC-TR-57-455(Pt. III)

Midwest Research Inst., Kansas City, Mo.

HIGH TEMPERATURE SOLID DRY FILM LUBRICANTS. [Period covered]: January 1, 1958 to December 31, 1958. Melvin T. Lavik. Mar. 31, 1959. 66p. Project Nos. 7331 and 3044. Contract AF33(616)-3684.

Chemical stability and coefficient of friction have been determined for selected materials. Changes in weight, color, and physical appearance were noted when heated to 1000°F in air. A special pellet friction machine was used to determine coefficients of friction at these temperatures while under light loads. Silicon dioxide films have been prepared with and without solid lubricants from a hydrolyzed tetraethyl orthosilicate solution. Similar films were prepared using boric oxide; low coefficients of friction and reasonable wear-lives were obtained. Samples of five commercial lubricants were irradiated at levels up to 10^9 roentgens (gamma) and 3×10^{16} NVT (neutron). Wear-life tests on the irradiated samples, although not conclusive, indicate that the radiation has little permanent effect on the lubricative properties of the films. (auth)

7309 WADC-TR-58-382(Pt. II)

Brooklyn. Polytechnic Inst.

SYNTHESIS AND EVALUATION OF NEW POLYMERS PREPARED BY STEREOSPECIFIC CATALYSIS. [Period covered] June 1958 to June 1959. Charles G. Overberger. June 1959. 88p. Project title: NON-METALLIC AND COMPOSITE MATERIALS. Task title: NEW CHEMICALS AND METHODS. Contract AF33(616)-5253.

3-trifluoromethyl-4-butene and 4,4,4-trifluoro-1-butene were prepared. Trifluoromethylacrylonitrile was synthesized and polymerized with several bases. Methylenecyclobutane, methylenecyclohexene, and vinylcyclopropane were prepared. Pure cis or trans 2-methylvinylcyclohexane was synthesized, and polymerized with a Ziegler-Natta catalyst. An isotope effect on the degree of polymerization was not found in the polymerization of alpha-deuterovinylcyclohexane with the Ziegler-Natta catalyst. The degree of polymerization of polymethacrylonitrile from potassium catalysis in liquid ammonia solvent was found to be independent of monomer and catalyst concentrations. Water was found to exert an effect on this system. (auth)

7310 AEC-tr-3964

A NEW OXIDIZING AGENT FOR THE QUANTITATIVE CONVERSION OF CARBON MONOXIDE TO CARBON DIOXIDE. A CONTRIBUTION TO THE CHEMISTRY OF IODINE PENTOXIDE. Max Schutze. Translated by George J. Kamin (Ames Lab.) from Ber. deut. chem. Ges. 77B, 484(1944). 6p. JCL.

A method for quantitative conversion of CO to CO_2 with a mixture of I_2O_5, concentrated H_2SO_4, and pulverized silica gel is described. Advantages over previously used methods are discussed, and preparation of the reagents is described. (J.R.D.)

7311 CEA-tr-R-759

ETAT ACTUEL DE LA MICROSCOPIE ÉLECTRONIQUE PAR TRANSPARENCE ET SON EMPLOI DANS LES RECHERCHES PHYSICOCHIMIQUES. (Actual State of Electron Microscopy by Transparence and its Use in Physicochemical Investigations). V. M. Luk'yanov (Lukianovich). Translated into French by B. Vinogradoff from Uspekhi Khim. 27, 690-6(1958). 70p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 14098.

7312 CEA-tr-R-766

FIXATION DE L'URANIUM PAR LES ACIDES HUMIQUES ET PAR LES MELANOIDINES. (Fixation of Uranium by Humic Acids and by Melanoidins). S. M. Manskaya, T. V. Drozdova, and M. P. Emel'yanova (Emelianova). Translated into French from Geokhimiya No. 4, 10-23(1956). 34p.

An experimental study was made of the possible processes of transport and fixation of U by natural organic materials such as fulvo acids, humic acids, and melanoidins. Solutions of uranyl salts reacted to form fulvates and humates at different solubilities according to pH. The results show that it is the fulvo acids which make transport of U by natural waters possible. The properties of the fulvate and humate complexes indicated their probable occurrence in uraniferous peats; this was demonstrated by chromatography. It is suggested that U may also be concentrated in the chitinous carapaces of living creatures and in their decomposition products, specifically melanoidin. (T.R.H.)

7313 JPRS-2149-N

SOME OF CHINA'S RESEARCHES ON ION-EXCHANGE RESINS. Ping-lin Ho. Translated from Kao-fen-tzu T'ung-hsun 3, 210-24(1959). 18p. OTS.

Chinese developments in research and synthesis of ion exchange resins are reviewed. Some applications in the fields of medicine and chemistry are mentioned briefly. (C.H.)

7314 UCRL-Trans-122

MEETING ON THE OCCASION OF THE 50 YEAR DOCTOR JUBILEE OF PROF. DR. JULIUS MEYER, CLAUSTHAL, MAY 9, 1950. Translated for Univ. of California Radiation Lab. from Angew. Chem. 62, 423-14(1950). 2p. JCL.

Preparation of the compound $B_2O_3Cl_3$ by double decomposition of boron trichloride and boron oxide is described. An analogous course of reaction is found in boron trifluoride and the bromide. These compounds are formed at above room temperature and upon cooling decompose into

the oxide and halogenide. A review of separation methods and other chemical properties and reactions of rare earths are also presented. An abstract on the preparation of rare earth carbides is also included. (J.R.D.)

7315

GAS REACTIONS OF CARBON. P. L. Walker, Jr., Frank Rusinko, Jr., and L. G. Austin (Pennsylvania State Univ., University Park). Advances in Catalysis 11, 133-221 (1959).

The thermodynamics, kinetics, and general mechanisms of carbon–oxygen, carbon–carbon dioxide, carbon–hydrogen, and carbon–steam reactions are reviewed. The role of mass transport in gas–carbon reactions is described. The effects on carbon reactivity of crystallite orientation, crystallite size, surface area, irradiation, impurities, heat treatment, and addition of halogens to the reacting gas are discussed. The use of bulk-density and surface-area data on reacted carbons for studying reaction mechanism is discussed. (C.J.G.)

7316

EFFECT OF CENTRIFUGATION ON SOLUTION TEMPERATURE AND SOLUBILITY OF TRIBUTYL PHOSPHATE AND TRIBUTYL PHOSPHINE OXIDE IN WATER. Cecil E. Higgins and Willis H. Baldwin (Oak Ridge National Lab., Tenn.). Anal. Chem. 32, 236-8(1960) Feb.

Centrifugation at 25°C with a laboratory clinical centrifuge raised the solution temperature of water saturated at 25°C with tributyl phosphate and tributyl phosphine oxide as much as 14°C. The "equilibrium" solubility of these compounds dropped accordingly. This adverse effect when magnified by auxiliary heat from infrared lamps provided a rapid method for studying the temperature dependence of solubility over a moderate range. The speed of determination was limited by the speed of the analysis itself. (auth)

7317

POSITION OF THE TRANSITION SERIES ON THE PERIODIC CHART. G. E. Villar (Instituto de Technología y Química de la Facultad de Ingeniería y Agrimensura, Montevideo). Bol. fac. ing. y agrimensura, Montevideo 7, No. 2, 3-16(1959) Apr. (In Spanish)

The "first transition series" is made up of the ten elements from scandium (Z = 21) to zinc (Z = 30). The electronic configurations of the first transition series elements are characterized by successive additions of electrons to the 3d level. Other transition series correspond to the first transition series in the subsequent periods. So then, lutetium (Z = 71) and the element 103, would occupy the place reserved for lanthanum (Z = 57) and actinium (Z = 89). The following modifications are proposed for the periodic chart: The subgroup III-a would be constituted by scandium (Z = 21), yttrium (Z = 39), lutetium (Z = 71) and element 103. Lanthanide series and actinide series would be placed out of the subgroup III-a. Lanthanide series would be constituted by Lanthanum and the 13 elements that follow it. Actinide series would be constituted by actinium and the 13 elements that follow it. (auth)

7318

THE CONSTITUTION OF LANTHANIDE SERIES, AND A DEDUCED LAW FOR THE ELECTRONIC CONFIGURATIONS OF THE SERIES' ELEMENTS. G. E. Villar (Instituto de Technología y Química de la Facultad de Ingeniería y Agrimensura, Montevideo). Bol. fac. ing. y agrimensura, Montevideo 7, No. 2, 17-24(1959) April. (In Spanish)

It is generally admitted that the place of lanthanum in the periodic chart is in the subgroup III-a. By analogy to the distribution of elements in the periods 4 and 5, it is deduced that the subgroup mentioned is constituted only by scandium, yttrium, lutetium and element 103, that are the first terms of the transition series where the electronic levels 3d, 4d, 5d and 6d are completed. The subgroup II-a is formed by alkaline earth metals. In period 6, the lanthanide series would occupy a place between barium (alkaline earth metal Z = 56) and lutetium (Z = 71). So, the elements of this series would be placed between the subgroup II-a and the subgroup III-a. Their electronic configurations would be characterized by the filling of the 4f level. The lanthanide series would be constituted by lanthanum and the 13 elements that follow it. Their position in the Periodic Chart would be out of the subgroup III-a, and not in this subgroup as the lanthanides are now situated. The electronic configurations of the lanthanide elements would satisfy the following law: (configuration of Xe) $4f^n6s^2$ (n = 1 to 14). The electronic configurations deduced by this formula coincide with the electronic configurations mentioned in 1958 by Seaborg, excepting the configurations of lanthanum and gadolinium. (auth)

7319

CONSTITUTION OF THE ACTINIDE SERIES AND A DEDUCED LAW FOR THE ELECTRONIC CONFIGURATION OF THE SERIES' ELEMENTS. G. E. Villar (Instituto de Technología y Química de la Facultad de Ingeniería y Agrimensura, Montevideo). Bol. fac ing. y agrimensura Montevideo 7, No. 2, 25-32(1959) April. (In Spanish)

The series of rare earths are situated in the periodic chart between the alkaline earth metals and the first elements of the transition series, that according to our deductions would be: scandium (Z = 21), yttrium (Z = 39), lutetium (Z = 71), and the element 103. Consequently, the second rare earths series would be placed between radium (Z = 88) and the element 103 that is the first element of the transition series corresponding to the period 7. This second rare earth series is constituted by actinium (Z = 89) and the 13 elements that follow it. Their position in the periodic chart would be out of the subgroup III-a, and not in this sub-group as the actinides are now placed. The electronic configurations of the actinide elements are characterized by the fulfil of the 5f level, and would satisfy the following law: (Configuration of Rn) $5f^n7s^2$ (n = 1 to 14). (auth)

7320

THE POLYSULFIDES OF THE RARE EARTH ELEMENTS. J. Flahaut, M. Guittard, and M. Patrie (Faculté di Pharmacie, Paris). Bull. soc. chim. France No. 11-12, 1917-20(1959) Nov-Dec. (In French)

The sulfides of the rare earths and yttrium can fix sulfur and form polysulfides. Those of La, Ce, Pr, and Nd correspond to the formula Me_2S_4 and are cubic. Those of Gd, Dy, and Y approach the composition $Me_2S_{3.33}$, which appears to be the lower limit of a region of hypothetical homegeneity extending up to the stoichiometric composition. They are quadratic pseudo-cubic. The polysulfide of samarium, although not having the stoichiometric composition, is cubic. It has a homogeneous region connected to a loss of sulfur and shown by a quadratic deformation of the cell. (tr-auth)

7321

THE OXYSELENIDES OF THE ELEMENTS OF THE RARE EARTH GROUP. André Benacerraf, Micheline Guittard, Louis Domange, and Jean Flahaut (Faculté de Pharmacie, Paris). Bull. soc. chim. France No. 11-12, 1920-2(1959) Nov.-Dec. (In French)

The oxyselenides of La, Ce, Pr, Nd, Sm, Gd, Dy, Er, Yb,

and Y, with the general formula Me_2O_2Se, possess the same crystalline structure as the corresponding oxysulfides Me_2O_2S. The crystalline parameters are given, and some physical and chemical properties are described. (tr-auth)

7322

PREPARATION OF DEUTERATED HALOGENOFORMS. Marie-Thérèse Forel, Jean-Pierre Leicknam, and Marcel Paty (Faculté des Sciences, Bordeaux). Bull. soc. chim. France No. 11-12, 1922-3(1959) Nov.-Dec. (In French)

The four halogenoforms, fluoroform, chloroform, bromoform, and iodoform, were prepared by methods giving easily pure chemical compounds and high isotopic contents. The Messinger method used for the synthesis of $CDCl_3$ and $CDBr_3$ permitted some data on the mechanism of this reaction to be obtained. (tr-auth)

7323

SOME DEUTERIUM ISOTOPE EFFECTS. I. WATER SOLVOLYSIS OF METHYL-d_3 ESTERS. J. A. Llewellyn, R. E. Robertson, and J. M. W. Scott (National Research Council, Ottawa). Can. J. Chem. 38, 222-32(1960) Feb.

The α-deuterium isotope effect was examined for the solvolysis of a series of esters containing a fully deuterated methyl group. The possible sources of the effect were divided into "thermodynamic" effects which appear to favor more rapid reaction of the protium compound and "zero point" effects where stiffening of out-of-plane vibrations may account for the direction of the observed isotope effects. It appears that the inverse isotope effect may be a measure of the spatial restrictions placed on the hydrogen atoms on the carbon atom in the activated complex. (auth)

7324

DEUTERIUM ISOTOPE EFFECTS IN ORGANIC CATIONS. R. Stewart, A. L. Gatzke, M. Mocek, and K. Yates (Univ. of British Columbia, Vancouver). Chem. & Ind. (London) No. 10, 331-2(1959) Mar. 7.

The effect of deuterium substitution for hydrogen on the equilibrium constants governing the formation of the ions $(C_6H_5)_2CD^+$, $(p\text{-}MeOC_6H_4)_2CD^+$, and $p\text{-}ClC_6H_4CDOH^+$ is reported. The equilibrium isotope effects (K_H/K_D) were determined for benzhydrol and 4:4′ dimethoxybenzhydrol to be 1.32 and 1.18, respectively. A small stabilizing effect appeared to exist when the aldehyde hydrogen in p-chlorobenzaldehyde conjugate acid is replaced by deuterium. (C.J.G.)

7325

KINETIC ISOTOPE EFFECTS IN THE BENZOYLATION OF ANILINE. J. J. Elliott and S. F. Mason (The University, Exeter, Eng.). Chem. & Ind. (London) No. 15, 488-9(1959) Apr. 11.

The kinetic isotope effects in the benzoylation of various deutero-anilines were found to support an ionic model of the transition state (transition state more polar than the reactants). Bimolecular rate constants for the reaction of aniline and its deutero derivatives in a benzoyl chloride in benzene solution at 25°C are given. (C.J.G.)

7326

KINETICS, REACTION MECHANISMS AND DEUTERIUM ISOTOPE EFFECTS IN THE ALDOL CONDENSATION OF ACETALDEHYDE. Y. Pocker (University Coll., London). Chem. & Ind. (London) No. 19, 599-600(1959) May 9.

In the aldol condensation of acetaldehyde, catalyzed by hydroxide ions, a proof is given for the relation $k_2[MeCHO] \gg k_{-1}[H_2O]$ in solvent water for high aldehyde concentrations. The deuterium isotope effects are discussed. (C.J.G.)

7327

INVERSE ISOTOPE EFFECTS. A. Llewellyn, R. E. Robertson, and J. M. W. Scott (National Research Council, Ottawa). Chem. & Ind. (London) No. 24, 732(1959) June 13.

The reactivities of methyl-d_3 bromide, methyl-d_3 iodide, and methyl-d_3 toluene-p-sulfonate were measured. The substitution of α-deuterium in the above compounds was found to cause an increase in the hydrolysis rate. Inverse isotope effects are discussed. (C.J.G.)

7328

AROMATIC TRITIUM EXCHANGE IN WATER AND DEUTERIUM OXIDE. V. Gold, R. W. Lambert, and D. P. N. Satchell (King's Coll., London). Chem. & Ind. (London) No. 42, 1312-13(1959) Oct. 17.

Experimental evidence is presented on the exchange mechanism of acid-catalyzed deuterium loss from aromatic compounds. The mechanism involves a rapidly attained protonation equilibrium of the aromatic substrate and subsequent slow rearrangement of that conjugate acid. A study of the loss of tritium from [Ø-T]p-cresol to aqueous HCl and mixtures of the two as solvents confirmed the dependence of the reaction velocity on Hammett's acidity function. A plot of the log of the velocity constant vs. H_0 gave the value −1.23 against −1.14 for the analogous deuterium exchange. The exchange of [Ø−T]p-cresol was 2 to 3 times slower than that of [Ø−D] p-cresol in 3.5 to 6.5N HCl. For 4N HCl, tritium loss in D_2O solution is 1.6 times faster than in H_2O. The experimental observations are interpreted in terms of the exchange mechanism. (C.J.G.)

7329

SECONDARY α-DEUTERIUM ISOTOPE EFFECT: THE MECHANISM OF THE CIS-TRANS ISOMERISATION OF MALEIC ACID. S. Seltzer (Brookhaven National Lab., Upton, N. Y.). Chem. & Ind. (London) No. 42, 1313(1959) Oct. 17.

The cis−trans isomerization of maleic acid to fumaric acid, catalyzed by aqueous potassium thiocyanate, was investigated and found to be consistent with Streitwieser's analysis of the secondary α−deuterium isotope effect. Maleic acid with maleic acid-2:3-d_2 exhibited an inverse isotope effect, $k_H/k_D = 0.885 \pm 0.012$ at 80°C. Carbon 2 or 3, having sp^2-hybridization in the initial state (C−H out-of-plane bending frequency: ~700 cm^{-1}), was partially converted to an sp^3-tetrahedral carbon in the transition state. (C.J.G.)

7330

KINETIC AND EQUILIBRIUM SECONDARY ISOTOPE EFFECTS IN CARBONYL REACTIONS. M. L. Bender, M. S. Feng, and J. M. Jones (Illinois Inst. of Tech., Chicago). Chem. & Ind. (London) No. 43, 1350(1959) Oct. 24.

The methyl hemiacetal dissociation constants were determined for cyclopentanone and cyclopentanone-2, 2, 5, 5-d_4 in dioxane at 25°C over the following range of concentrations: acetone, 0.04 to 0.004 M; methanol, 0.70 to 0.50 M; and hydrogen chloride, 0.005 to 0.100 M. The results are interpreted relative to secondary isotope effects in terms of hyperconjugation. (C.J.G.)

7331

DEUTERIUM ISOTOPE EFFECTS DURING ADDITIONS TO DEUTERATED AND NON-DEUTERATED OLEFINS. D. B. Denney and N. Tunkel (Rutgers Univ., New Brunswick, N. J.). Chem. & Ind. (London) No. 44, 1383(1959) Oct. 31.

Deuterium isotope effects were found to exist in simple addition reactions to deuterated and non-deuterated olefins. The isotope effects were measured for various additional reactions. (C.J.G.)

7332

THE AFFINITY SEQUENCES OF CATION-EXCHANGE RESINS. J. Kennedy and V. J. Wheeler (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Chem. & Ind. (London) No. 50, 1577(1959) Dec. 12.

The absorption sequence of polymeric diallyl phosphoric acid gives the normal order (Cs > Rb > K > Na > Li) for all alkali metals under acid conditions, and the sequence Cs > Rb > Na when in the sodium form. A reversal of the normal order was observed for H^+ and polyvalent cations. This reversal of affinity sequences is interpreted as: with ions of lower field strength (alkali metals) the induced dipole (polarizability × electrostatic field) would be much lower and the affinity sequence more dependent on permanent dipoles which are probably in the order H_2O > PO_4^- > SO_3^-. (C.J.G.)

7333

EFFECTS OF HYDROGEN ON INSERTION COMPOUNDS OF GRAPHITE WITH ALKALI METALS. Albert Hérold and Daniel Saehr. Compt. rend. 250, 545-6(1960) Jan. 18. (In French)

The graphite compound C_8K fixes H at ambient temperature to form a dark blue product containing 0.75 atoms of H per atom of metal. $C_{24}K$ reacts with more difficulty and fixes only 0.25 H atoms/atom. The reactions are reversible. (tr-auth)

7334

THE TRANSURANIC ELEMENTS. A SURVEY OF DIFFERENT METHODS USED DURING THE COURSE OF THEIR DEVELOPMENT. Stanley G. Thompson (Univ. of California, Berkeley). Énergie nucléaire 1, 254-61 (1959) Nov.-Dec. (In French)

The methods of preparation, purification, and identification of the transuranic elements are reviewed. Each element or pair of elements is considered in their order of discovery. Preparation of target material and rapid techniques developed to cope with short lifetimes are emphasized. (T.R.H.)

7335

THE FUTURE OF TRANSURANIC ELEMENTS, THEIR USES AND POSSIBILITIES FOR NEW ELEMENTS. Wilhelm Forsling. Énergie nucléaire 1, 262-70(1959) Nov.-Dec. (In French)

The possibility of discovering new elements, even with shorter and shorter periods, is discussed. The various methods of preparing and identifying new elements are considered as to their advantages and disadvantages, and two possible processes for elements 103 and 104 are described. Element 104 will be similar to Hf in properties. The future uses of transuranic elements in reactors and in fundamental studies of matter are pointed out. (T.R.H.)

7336

PREPARATION OF VERY PURE BORON FOR USE AS NEUTRON ABSORBER IN NUCLEAR REACTORS. Angelo di Loreto (Université, Rome). Énergie nucléaire 1, 289-90(1959) Nov.-Dec. (In French)

A process for preparing boron is described. It is based on three reactions: formation of KBF_4 by the action of KOH on HBF_4, transformation of KBF_4 to BCl_3 by $AlCl_3$, and displacement of B from BCl_3 by Zn. (T.R.H.)

7337

UTILIZATION FACTORS FOR FAST FISSION IN A CELL. Guillermo Velarde (Junta de Energia Nuclear, Madrid). Energia nuclear (Madrid) 3, No. 12, 14-26(1959) Oct.-Dec. (In Spanish)

A manual method for calculating thermal, resonant, and fast fission utilization factors is presented which supplements a previous method given for calculating neutron flux in two- or three-group theory without a digital computer. Diffusion theory corrected by transport theory is used to obtain results analogous to those of P_3 and S_4 approximations. (T.R.H.)

7338

KINETICS AND MECHANISMS FOR THE OXIDATION OF TRIVALENT PLUTONIUM BY NITROUS ACID. E. K. Dukes (E. I. du Pont de Nemours & Co., Aiken, S. C.). J. Am. Chem. Soc. 82, 9-13(1960) Jan. 5.

The rate of oxidation of plutonium(III) by nitrous acid was investigated in nitric, hydrochloric, and perchloric acids. The rate expressions obtained were in HCl or $HClO_4$, $-d[Pu(III)]/dt = K_1[Pu(III)][H^+][HNO_2]$; in HNO_3, $-d[Pu(III)]/dt = K_2[Pu(III)][H^+][NO_3^-][HNO_2]$ where $K_1 = 18 \pm 3.5$ moles^{-2} min^{-1} and $K_2 = 90 \pm 20$ moles^{-3} min^{-1}. The proposed mechanisms for the oxidation of Pu(III) by nitrous acid involve N_2O_4 as an intermediate in HNO_3 and NO^+ as an intermediate in HCl or $HClO_4$. Activation energies of 14.0 ± 0.5 and 6.0 ± 0.3 kcal/mole were found for K_1 and K_2. Studies were made with solutions 10^{-3} to 10^{-6} molar in plutonium and the change in distribution coefficient of plutonium into 30 vol % tributyl phosphate (TBP) was used to follow the reaction. (auth)

7339

THE OXIDATION OF CAPTIVE OXALATE. Patricia Saffir and Henry Taube (Univ. of Chicago). J. Am. Chem. Soc. 82, 13-14(1960) Jan. 5.

The oxidation of $(NH_3)_5CoC_2O_4^+$ by Ce(IV) takes place with almost perfect stoichiometry, one Ce(IV) being consumed for each mole of the Co(III) complex, and one Co^{2+} being formed. The Co^{3+} aquopentammine complex and $S_2O_8^{2-}$ with Ag^+ as catalyst behave similarly. However, H_2O_2 catalyzed by Mo(VI), and Cl_2 act to preserve the oxidation state of Co(III) and $(NH_3)_5CoOH_2^{3+}$ is formed. The difference in behavior of the two classes of oxidizing agents is ascribed to this: Ce(IV), Co(III), and some intermediate in the $S_2O_8^{2-} + Ag^+$ system act by extracting one electron at a time, while the other two act in a manner which is equivalent to extracting two electrons simultaneously. (auth)

7340

ACIDITY CONSTANTS OF SOME HAMMETT INDICATORS IN HEAVY WATER. THE HAMMETT ACIDITY FUNCTION, D_0, FOR DCl and D_2SO_4 SOLUTIONS. E. Högfeldt and J. Bigeleisen (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 82, 15-20(1960) Jan. 5.

Dissociation constants of 14 Hammett indicators with pK values in the range 3.3 to −5.5 were determined in D_2O solutions of DCl and D_2SO_4. A correlation is made of $pK_{BD^+} - pK_{BH^+}$ as a function of acid strength. The data are used used to establish the Hammett acidity function, D_0, for DCl solutions in D_2O in the range 10^{-4}–1 M and for D_2SO_4 solutions in the range 10^{-4}–12 M. D_0 is found to be equal to H_0 for "HCl" solutions and equal to $-\log C_{acid}$. D_0 for D_2SO_4 is found to be the same as H_0 for H_2SO_4 except in the range 10^{-3}–10^{-1} M. The different behavior in this region is a consequence of the differences in the dissociation constants of HSO_4^- and DSO_4^-. (auth)

7341

METAL TETRAZOLE COMPLEXES: BIS-(5-AMINOTETRAZOLATO)-COPPER(II). Carl H. Brubaker, Jr. (Michigan State Univ., East Lansing and Universidad de Chile, Santiago). J. Am. Chem. Soc. 82, 82-5(1960) Jan. 5.

Two crystalline forms of bis-(5-aminotetrazolato)-

copper(II) were prepared and characterized. Visible and ultraviolet spectra of aqueous copper(II)–5-aminotetrazole solution were examined. Continuous variation experiments reveal 1:2 interactions and a formation constant for the complex in solution was determined to be about 10^{12}. Infrared studies suggest coördination involves the ring and not the 5-amino group. Acids decompose the complexes and bring about rupture of the tetrazole ring, while decomposition by ammonia does not affect the ring. (auth)

7342

MECHANISMS OF ELIMINATION REACTIONS. IV. DEUTERIUM ISOTOPE EFFECTS IN E2 REACTIONS OF SOME 2-PHENYLETHYL DERIVATIVES. William H. Saunders, Jr. and David H. Edison (Univ. of Rochester, N. Y.). J. Am. Chem. Soc. 82, 138–42(1960) Jan. 5.

Kinetic deuterium isotope effects were determined for E2 reactions of the compounds $C_6H_5CD_2CH_2X$. The values of k_H/k_D with sodium ethoxide in ethanol are in the order Br > OTs > SMe_2 > NMe_3. A change of base and medium to potassium t-butoxide in t-butyl alcohol increases the isotope effect with the bromide and the tosylate. Experiments with sodium hydroxide in water on the onium salts show no clear pattern. The relation of the present work to other recent studies on the nature of the transition state in E2 reactions is discussed. Some rate constants previously given for 2-(p-acetylphenyl)-ethyldimethylsulfonium bromide are shown to be in error. An interesting case of anomalous orientation in a Friedel-Crafts acylation is reported. (auth)

7343

QUATERNARY SALT FORMATION OF SUBSTITUTED OXAZOLES AND THIAZOLES. Vernon N. Kerr, Donald G. Ott, and F. Newton Hayes (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 82, 186–9(1960) Jan. 5.

The course of quaternization of a number of oxazoles and thiazoles and various dimethylaminophenyl, pyridyl, and quinolyl derivatives was investigated. The salts were screened for hypotensive activity. (auth)

7344

ACTIVATION ENERGY MEASUREMENTS IN THE REACTION BETWEEN IODIDE AND PERSULFATE IONS IN THE PRESENCE OF DIFFERENT SALTS. Antonio Indelli and Edward S. Amis (Univ. of Arkansas, Fayetteville). J. Am. Chem. Soc. 82, 332–8(1960) Jan. 20.

The rate of the reaction between persulfate and iodide was measured at six temperatures in the presence of KCl, NaCl, $MgCl_2$, $LaCl_3$, $Co(NH_3)_6Cl_3$, and $UO_2(NO_3)_2$ (the latter only at 25°), at ionic strengths ranging from 0.0067 to 0.107M. The temperature coefficient usually increases when the ionic strength is increased to 0.02 to 0.03M, but, at least for KCl, NaCl, and $MgCl_2$, at higher ionic strengths it decreases again. This fact cannot be interpreted by ordinary electrostatics. The difference in the temperature coefficient among various salts can explain the difference in the salt effects, the extent of which depends very specifically upon the nature of the cation. The $UO_2(NO_3)_2$ has a rather small accelerating effect on the reaction between persulfate and iodide, but it catalyzes markedly the reaction between persulfate and thiosulfate. The spectrum of the UO_2^{++} ion is strongly modified by the presence of thiosulfate. A model is proposed for the mechanism of the non-electrostatic salt effect, which takes into account the polarization of the anion produced by a neighboring cation, and the lowering of the energy barrier in the electron transfer. The parallelism existing between the extent of the salt effect and the limiting equivalent conductivity of the cation is discussed in relation to this model. (auth)

7345

ANION-EXCHANGE STUDIES. XXVII. ABSORBABILITY OF A NUMBER OF ELEMENTS IN HCl–HF SOLUTIONS. Frederick Nelson, Richard M. Rush, and Kurt A. Kraus (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 82, 339–48(1960) Jan. 20.

Nineteen elements including some from groups 2, 3, 4, 5, and transition elements were studied at constant 1 M HF and variable HCl concentration (0.1 to 11 M). The data are compared with adsorbabilities in HCl solutions, not containing HF. A large group of elements which are nonadsorbable from HCl solutions are also not adsorbed from HCl–HF mixtures. This group includes even such highly charged ions as Al(III), Y(III), Eu(III), Th(IV), and V(IV). Be(II) shows some adsorption at low HCl concentration in the presence of 1 M HF. The adsorption functions of many elements adsorbable from HCl solutions show little change on addition of HF. The adsorption functions may be substantially altered as shown for Sc(III), Ti(IV), Fe(III), Ga(III), Ge(IV), Sn(II) and (IV), and Sb(III) and (V). From the adsorption functions in HCl and HCl–HF, estimates of the extent of fluoride complexing are obtained. Application of the adsorption data to separations is discussed and illustrated with typical cases. (auth)

7346

ZIRCONIUM COMPLEXES IN AQUEOUS SOLUTION. I. REACTION WITH MULTIDENTATE LIGANDS. Benjamin I. Intorre and Arthur E. Martell (Clark Univ., Worcester, Mass.). J. Am. Chem. Soc. 82, 358–64(1960) Jan. 20.

A study of the interaction of Zr(IV) with a wide variety of chelating agents resulted in the discovery of a number of chelates with multidentate oxygen donor groups stable over a wide range of pH. The most stable chelate compounds were formed with disodium 1,2-dihydroxybenzene-3,5-disulfonate, diethylenetriaminepentaacetic acid, nitrilotriacetic acid, N-hydroxyethylethylenediaminetriacetic acid, N-hydroxyethyliminodiacetic acid, and N,N-dihydroxyethylglycine. Ethylenediaminetetraacetic acid was less effective, while trimethylenediaminetetraacetic acid does not lead to the formation of soluble complexes. (auth)

7347

ORGANOBORON COMPOUNDS. XII. IDENTIFICATION OF THE PRESUMED ALKOXYDIFLUOROBORANES AS COÖRDINATION COMPOUNDS OF TRIALKYL BORATES AND BORON FLUORIDE. Patrick A. McCusker and S. M. Laeticia Kilzer (Univ. of Notre Dame, Ind.). J. Am. Chem. Soc. 82, 372–5(1960) Jan. 20.

The substances reported as alkoxydifluoroboranes (formed by the reaction of boron fluoride with trialkyl borates) have properties which are more characteristic of coördination compounds than of substituted boranes. A consideration of vapor densities, cryoscopic molecular weights, distillation behavior, electric moments and reaction with nitrogen bases leads to the identification of the presumed alkoxydifluoroboranes as coördination compounds of trialkyl borates and two moles of boron fluoride. Comparison of these substances with the well established ether–boron fluoride coördination compounds supports their identification as coördination compounds. (auth)

7348

THE SYNTHESIS OF NITROGEN-CONTAINING KETONES. VIII. THE ACYLATION OF 3-PICOLINE, 4-PICOLINE AND CERTAIN OF THEIR DERIVATIVES. Stuart Raynolds and Robert Levine (Univ. of Pittsburgh). J. Am. Chem. Soc. 82, 472–5(1960) Jan. 20.

3-Picoline, 4-picoline and some of their derivatives were acylated at their side chains to give high yields of the corresponding ketones containing pyridine rings. It was possible to effect the direct acylation of 3-picoline with aliphatic esters to give alkyl 3-picolyl ketones using sodium diisopropylamide as the condensing agent. (auth)

7349

THE ACID-CATALYZED REARRANGEMENT OF CINENIC ACID. V. EVIDENCE FOR A DECARBONYLATION-RECARBONYLATION MECHANISM. Jerrold Meinwald, Ho Chien Hwang, David Christman, and Alfred P. Wolf (Cornell Univ., Ithaca, N. Y. and Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 82, 483-6(1960) Jan. 20.

A series of steps involving the loss and subsequent recapture of carbon monoxide is suggested to account for the carboxyl group transfer characteristic of the cinenic acid rearrangement (I → II). This reaction sequence is compatible with earlier observations, and can be supported by analogies at every stage. The participation of carbon monoxide is indicated by an experiment in which the rearrangement, carried out in the presence of excess carbon monoxide, gave a significantly increased yield of geronic acid (II). Rearrangement in the presence of C^{14}-labeled carbon monoxide yielded labeled geronic acid. The possibility that this incorporation is due to exchange of the carboxylic carbon of either the starting material I or the product II with the externally supplied carbon monoxide is excluded by appropriate control experiments. (auth)

7350

MASS SPECTRUM OF PROPANE: ISOTOPE EFFECT AND METASTABLE IONS. Allen Kropf, Edward M. Eyring, Austin L. Wahrhaftig, and Henry Eyring (Univ. of Utah, Salt Lake City). J. Chem. Phys. 32, 149-57(1960) Jan.

The mass spectra of propane and of propane-2,2-d_2 were calculated assuming that the mass spectra result from successive and competing unimolecular reactions following initial vertical ionization of the parent molecules. Reasonable agreement with experiment is found for the change in mass spectral pattern with deuterium substitution. The metastable ion peaks are shown to be a normal part of the mass spectrum. (auth)

7351

VIBRATIONAL SPECTRA OF OsF_6 AND PtF_6. Bernard Weinstock, Howard H. Claassen, and John G. Malm (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 32, 181-5(1960) Jan.

Infrared absorption spectra of gaseous OsF_6 and PtF_6 from 6–50μ and the Raman spectrum of liquid OsF_6 are reported. These are interpreted in terms of the octahedral point group O_h, and the six fundamental frequencies are determined. Their values and symmetry species are for OsF_6 733 (a_{1g}), 632 (e_g), 720 (f_{1u}), 268 (f_{1u}), 252 (f_{2g}), and 230 (f_{2u}); for PtF_6 655 (a_{1g}), 601 (e_g), 705 (f_{1u}), 273 (f_{1u}), 242 (f_{2g}), and 211 (f_{2u}). Thermodynamic functions, including electronic contributions, are calculated for the ideal gaseous state of both compounds. A comparison of the details of the vibrational spectra of eleven hexafluorides reveals certain characteristic features of OsF_6 and ReF_6. Since only these two molecules have appropriately degenerate electronic ground states these differences are interpreted as evidence of a Jahn-Teller effect. (auth)

7352

KINETICS OF STRONTIUM OXIDE ON TUNGSTEN. J. A. Cape and E. A. Coomes (Univ. of Notre Dame, Ind.). J. Chem. Phys. 32, 210-14(1960) Jan.

Field electron microscopy was used to study the kinetics of strontium oxide on tungsten in the range 900 to 2200°K. Reactions take place on the {111} and {100} which have high concentrations of four nearest neighbor surface atoms. Below 1150°K there is some evidence for the dissociation of SrO and migration of Sr to the {110} edges where clusters of crystallites are formed. Two modifications of field emission patterns associated with the (Sr–O–W) complex within 1150 to 1550°K are tentatively identified with the basic and normal tungstate; apparently the first goes over to the second with an activation energy of ~60 kcal as determined from desorption data. An unusually sharp decrease in Fowler-Nordheim work function occurs during this reaction. In the later stages of desorption above 1550°K patterns identifiable with an oxygen-tungsten surface are obtained. Desorption at this stage takes place with an activation energy of ~140 kcal. (auth)

7353

ELECTRON SPIN RESONANCE OF AN IRRADIATED SINGLE CRYSTAL OF ALANINE: SECOND-ORDER EFFECTS IN FREE RADICAL RESONANCES. Ichiro Miyagawa and Walter Gordy (Duke Univ., Durham, N. C.). J. Chem. Phys. 32, 255-63(1960) Jan.

The electron spin resonance of single crystals of l- and d-alanine was observed at T = 300°K and analyzed for different orientations of the crystal in the magnetic field and at several microwave frequencies ranging from 9 kMc/sec to 34 kMc/sec. The stable free radical produced by the irradiation is proved to be of the form $CH_3\dot{C}HR$, where R is a group which has no nuclei with detectable coupling. The hydrogens of the CH_3 group of the radical are shown to have equivalent, isotropic coupling of 26 gauss each, essentially independent of the frequency of observation. This CH_3 group coupling is interpreted as arising from s orbital spin density of the hydrogens, via hyperconjugation. The hydrogen of the CH group has both an isotropic, Fermi term, A_f = 20 gauss, arising from s orbital density on the hydrogen, and an anisotropic term A_μ = 7 gauss arising from dipole-dipole interaction of the proton moment with the electron spin density, ρ_C, on the carbon. Although the signs of A_f and A_μ could not be learned, they are shown to be of opposite sign. Hence the spin density is negative on either H or C. Principal values of the CH coupling are A_1 = 7 gauss, $A_2 = A_3$ = 27 gauss. The value of ρ_C is shown to be 0.80 approximately. For certain orientations of the crystal the CH coupling becomes equal to the CH_3 coupling, and a quintet pattern is observed. Interesting second-order transitions are observed which for the [001] orientation become in the region of 24 kMc/sec as strong as the normal first-order transitions. A general theory is developed which accounts satisfactorily for these second-order effects which are probably of consequence in the electron spin resonance patterns of numerous other free radicals trapped within solids. (auth)

7354

NEGATIVE ION FORMATION IN NO_2 BY ELECTRON ATTACHMENT. R. E. Fox (Westinghouse Research Labs., Pittsburgh). J. Chem. Phys. 32, 285-7(1960) Jan.

Negative ion formation in NO_2 by electron attachment is studied at low pressures as a function of electron energy in a mass spectrometer. The principle ion formed is found to be O^- which onsets at 1.35 ± 0.05 ev and whose apparent maximum occurs at 1.90 ev. Comparison of the peak shape with the electron energy distribution indicates the maximum cross section occurs within 0.1 ev of threshold. The NO_2^- ion whose maximum cross section is only about one-hundredth that for O^- appears to have the same energy dependence. Crude estimates of the cross section for attachment yield order of magnitude values of 10^{-18} cm^2 for O^- and 10^{-20} cm^2 for NO_2^-. (auth)

7355

NMR STUDY OF BONDING IN SOME SOLID BORON COMPOUNDS. A. H. Silver and P. J. Bray (Brown Univ., Providence). J. Chem. Phys. 32, 288-92(1960) Jan.

Nuclear magnetic resonance studies of B^{11} were performed in powder samples of some metal borides, boron-nitrogen compounds, borofluorides and borohydrides, and borates. The B^{11} nuclear electrical quadrupole interactions were measured and used in the Townes and Dailey approach to estimate the probable bonding electron configurations. (auth)

7356

FREE RADICALS FROM THE FLASH PHOTOLYSIS OF PHENOL. L. I. Grossweiner and E. F. Zwicker (Illinois Inst. of Tech., Chicago). J. Chem. Phys. 32, 305-6(1960) Jan.

The flash photolysis of phenol was studied between pH 3 and 14. It was reported that the photolysis of both aqueous phenol at pH 7 and the phenolate ion at pH 12 produces a short-lived absorption system with bonds below 400 mμ. The absorption spectrum of the phenoxy free radical, produced by flash photolysis of phenol in 1.0M NaOH, is presented. This spectrum was produced at pH 12 to 14 and the spectrum assigned to the phenol cation was produced at pH 3 to 12. The phenol radical cation is produced by ejection of a lone-pair electron from the hydroxyl group and is stabilized by interaction with the solvent; the results indicate it is acidic in water with a pK_α near 13. (B.O.G.)

7357

ISOTOPE EXCHANGE PROCESSES IN SOLID NITROGEN UNDER ELECTRON BOMBARDMENT. Ralph Klein and Erwin M. Hörl (National Bureau of Standards, Washington, D. C.). J. Chem. Phys. 32, 307-8(1960) Jan.

A known amount of $N^{14}N^{14}-N^{15}N^{15}$ mixture was admitted into a glass cryostat and condensed on a glass surface (target) cooled by liquid helium or liquid hydrogen. The solid nitrogen layer was then irradiated with electrons of 15 to 20 kev for times up to 60 min. Electron beam currents of 5 and 10 μa were used. After bombardment the deposit was evaporated and the gas collected. The $N^{14}N^{15}$ increase is reported in terms of G values. The G value for the exchange process was 0.2 at 4.2°K and 0.04 at 20°K. The lower G value at 20°K appears to be reflected in the lower glow intensity. (B.O.G.)

7358

STUDY OF RHOMBOHEDRAL V_2O_3 BY NEUTRON DIFFRACTION. A. Paoletti (Comitato Nazionale Ricerche Nucleari, Rome and Brookhaven National Lab., Upton, N. Y.) and S. J. Pickart (U. S. Naval Ordnance Lab., Silver Springs, Md. and Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 32, 308-9(1960) Jan.

Numerous investigations show anomalies in the behavior of V_2O_3 at 168°K and in the 370 to 500°K region. The magnetic susceptibility is a maximum at 168°K and is independent of temperature in the higher region. Abnormalities appear at 168 and 533°K in the specific heat, electrical conductivity, and thermal expansion. A neutron-diffraction study was made to observe any antiferromagnetic spin arrangement and to obtain some knowledge of the oxygen parameter. Neutron-diffraction patterns obtained from a V_2O_3 powder sample at 4.2 and 295°K are illustrated. Changes in the neutron-diffraction pattern can be accounted for by a structural transition. Prior evidence of such a transition was found by low-temperature x-ray studies. (B.O.G.)

7359

ULTRAVIOLET ABSORPTION SPECTRA OF ANODIC ZIRCONIUM OXIDE FILMS. R. E. Salomon, W. M. Graven, and G. B. Adams, Jr. (Univ. of Oregon, Eugene). J. Chem. Phys. 32, 310-11(1960) Jan.

Films of oxide were anodically formed on Zr foils in a sodium borate-boric acid solution buffered at pH 9. The foil was cleaned and etched almost to transparency. Absorption spectra for numerous films were obtained for formation voltages of 30 to 200v. The absorption spectra obtained for 150v formation of a typical film is included. By extrapolation the long wavelength limit of absorption is found to be 2500A. (B.O.G.)

7360

ISOTOPE EFFECTS IN THE CHROMIC ACID OXIDATION OF BENZYL-α-t ALCOHOL. Ernest M. Hodnett and Louis Kaplan (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 32, 312-13(1960) Jan.

The results of a study of the isotope effect in the oxidation of benzyl alcohol labeled with tritium on the methylene carbon atom is presented. Benzyl-α-t alcohol was prepared by reducing benzaldehyde with lithium aluminum hydride-t, and freed from benzaldehyde by washing its solution in benzene with sodium bisulfite. Aqueous solutions 0.025M in the alcohol, 0.3M in perchloric acid, and with various amounts of potassium dichromate were maintained at 37.5°C in a nitrogen atmosphere until the chromium (VI) was completely reduced. Aliquots were assayed for unreacted alcohol and aldehyde, and the specific activities, reaction rate ratios, and specific activity ratios of the aldehyde to those of alcohol were calculated. (B.O.G.)

7361

SUPER PURIFICATION OF GALLIUM. H. Merkel (Siemens-Schuckertwerke, A. G., Erlangen, Ger.). J. Less-Common Metals 1, 390-5(1959). (In German)

A method was developed for the preparation of very-pure gallium metal. It is based on the reaction of the impurities to nitrogen and gaseous ammonia. Impurities that form nitrides, especially iron, aluminum, titanium, magnesium, and others, are effectively removed. A description is given of a purification process which employs ammonia at 800°C. This is performed in an apparatus that enables the purifying agent, NH_3, to operate on very finely distributed gallium metal. (auth)

7362

THERMAL DIFFUSION AND THE APPROACH TO THE STEADY STATE IN GASES. II. S. C. Saxena and E. A. Mason (Univ. of Maryland, College Park). Mol. Phys. 2, 339-96(1959) Oct.

The theory of the rate of approach to the steady state in thermal diffusion is tested experimentally on the systems $He-Ar$, $He-CO_2$, H_2-CO_2, and D_2-CO_2 over a temperature range of about −78°C to 325°C. The course of the diffusion was followed by means of the radioactive tracers Ar^{37} and $C^{14}O_2$. The theory appears to be verified, and the results are used to calculate ordinary diffusion coefficients, which are in reasonable accord with previous measurements by other techniques. The thermal diffusion factors, which are obtained from the same measurements, appear to have reasonable accuracy. The experimental method appears to have promise as a sensitive method for the determination of forces between unlike molecules. (auth)

7363

DEUTERIUM−HYDROGEN EXCHANGE BETWEEN WATER AND MACROMOLECULES: ACCESSIBILITY OF CELLULOSE. John L. Morrison (Univ. of Toronto). Nature 185, 160-1(1960) Jan. 16.

A gravimetric method was employed to measure the exchange reaction of heavy water vapor with cotton and cotton mercerized in 18% sodium hydroxide. Data are tabulated

on the accessibilities of the two celluloses. The accessibility is defined as the ratio of the number of hydroxyl hydrogens exchanged to the total number in the cellulose. (C.H.)

7364

THE ABSORPTION AND FLUORESCENCE SPECTRA OF URANYL NITRATE SOLUTIONS AT ROOM TEMPERATURE. D. D. Pant and D. P. Khandelwal (D.S.B. Government Coll., Nainital, India). Proc. Indian Acad. Sci., Sec. A 50, 323-35(1959) Nov.

The fluorescence spectra of uranyl nitrate solutions at room temperature are shown to give four distinct series of bands, designated α, β, γ, and α', depending upon concentration, pH, etc. The α, β, and γ series are respectively shown to be probably due to the species UO_2^{2+}, $UO_2NO_3^+$, and $UO_2UO_2^{2+}$. Higher hydrolyzed species, when present, shift the spectrum toward the red. The species were identified with the help of absorption spectra and their comparison with the results of earlier workers. α' bands are probably due to a species of the type $UO_2(NO_3)_2$. The intensity distribution in the various series is studied and it is found that in α and γ bands the intensity distribution gets wider on dilution. The various characteristics observed as regards the behavior of the series are discussed on the basis of environmental differences of the species in the solid and solution states. A close resemblance between the spectra of hydrated solid UO_3 and γ bands is pointed out. (auth)

7365

ADSORPTION EQUILIBRIUM AND KINETICS IN THE INTERACTION OF ADSORBED ATOMS THROUGH A SURFACE ELECTRON GAS. L. I. Krishtalik. Zhur. Fiz. Khim. 33, 2729-31(1959). (In Russian)

Based on the Temkin «surface electron gas» model, equations were obtained for the equilibrium and kinetics of adsorption on metals, similar to equations for a heterogeneous surface and for repulsive forces diminishing with the distance. For this model the rate of reaction with the participation of a single adsorbed atom is independent to a first approximation of the rate of surface migration of the adsorbate. The effect of surface migration on the value of the b constant in the recombination theory of hydrogen overvoltage was noted. (auth)

7366

HIGH-RESOLUTION NUCLEAR MAGNETIC RESONANCE. J. A. Pople, W. G. Schneider, and H. J. Bernstein. McGraw-Hill Series in Advanced Chemistry. New York, McGraw-Hill Book Company, Inc., 1959. 511p.

The magnetic properties of nuclei and the properties of molecules in a magnetic field are discussed. The theory and phenomenological description of nuclear magnetic resonance (NMR) absorption is outlined. Experimental methods of observing nuclear resonance signals and measuring the NMR spectra of liquids and gases are discussed. The general features of NMR spectra and the quantum-mechanical theory of the frequencies and intensities of the lines in an NMR spectrum in terms of the chemical shifts and spin coupling constants are discussed. Theories of chemical shifts and nuclear spin-spin interactions and mechanisms which lead to spin-lattice relaxation are considered. The time-dependent factors which influence signal shape are discussed. The proton magnetic resonance spectra of hydrocarbons and the NMR of various elements are presented. The correlation of the spectra with molecular structure is considered. The NMR results obtained for the classes of compounds in which isomerism is due to a double bond, partial double-bond character, restricted rotation about a single bond, and restricted inversion at a nitrogen atom are discussed. Studies of molecular conformation, hydrogen bonding, and solvent effects by proton magnetic resonance and studies of keto-enol tautomerism and dissociation equilibria of aqueous electrolytes by NMR are discussed. (C.J.G.)

7367

REPORT OF THE NATIONAL CHEMICAL LABORATORY, 1958. London, Her Majesty's Stationery Office, 1959. 99p. $0.77.

Methods for the extraction and recovery of uranium from a variety of ores were studied. Extraction methods were studied for: thorium, by a branched chain amine; gold, recovery by cyanide complexes; beryllium; and the rare earths, by ion exchangers. Purification methods for various metals and organic compounds are reported. Polymer fractionation by methoxymethyl nylon membranes, by coacervate formation, and precipitation chromatography is reported. The results of immersed, atmospheric, and underground corrosion studies of metals are given. The structure and permeability of polymer membranes for use in electrodialytic cells for separating the constituents of solutions were studied. Chelating, ion-exchange, and electron-exchange resins and materials such as modified celluloses are evaluated for the separation of metals from solution. Studies on sulfate-reducing and sulfur-oxidizing bacteria and microbial formation of methane were performed. (C.J.G.)

7368

A STUDY OF THE LOW-TEMPERATURE CARBONIZATION OF D-GLUCOSE USING ELECTRON MAGNETIC RESONANCE AND INFRARED ABSORPTION. T. H. Brown and J. Turkevich (Princeton Univ., N. J.). p. 113-20 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

Dextrose was carbonized in vacuum at various temperatures up to 950°C. The electron spin resonance yielded the following information. The total number of unpaired electrons appeared to increase up to about 600°C. The line width (ΔH_{pp} which was initially constant) went through a minimum at 550 to 600°C. Thereafter ΔH_{pp} increased rapidly. The effects of O_2, N_2, H_2, and NO on the resonance absorption were as follows: H_2 and N_2 showed no observable effect while O_2 and NO appreciably broadened the absorption curve. The infrared absorption spectra of dextrose and a series of charcoals were determined in the range of 2 to 15μ by using the potassium bromide pellet technique. The sharp absorption peaks in the range of 7 to 10μ present in dextrose were replaced by a broad absorption band at low charring temperatures. With increasing temperature, the broad band became shallower. For charring temperatures above 500°C there was a constant absorption throughout the region 2 to 15μ. A Beer's Law relationship was found to hold for these charcoals and the resulting absorption coefficient was plotted against charring temperature. The absorption coefficient at various wave-lengths increased rapidly from the value for dextrose until a temperature of 500°C is reached, thereafter it appeared to remain constant. (auth)

7369

CHANGES IN THE MAGNETIC SUSCEPTIBILITY WITH THE DEGREE OF CARBONIZATION. P. Klive and S. Mrozowski (Univ. of Buffalo). p. 165-72 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

The diamagnetic susceptibility was determined at room and at liquid nitrogen temperatures for three soft

cokes, one hard coke, and one carbon black as a function of heat-treatment temperature (HT) in an effort to correlate the variations in the electric properties like Hall and thermoelectric effects with changes in the susceptibility. All carbons exhibited a paramagnetic minimum around HT 700°C. For heat-treated violanthrone the spin center concentrations were roughly determined in the range HT 300 to 1000°C using the paramagnetic resonance absorption method and taking DPPH as reference standard. The concentrations determined were just sufficient to explain the temperature dependence of the susceptibility. At higher heat treatments the diamagnetic susceptibility of all carbons increased with HT, surpassing the value expected for the molecular (London) susceptibility of very large condensed systems. It is concluded that the diamagnetic susceptibility observed in excess of the London diamagnetism is not due to the carriers responsible for the conduction (majority carriers). (auth)

7370

CATALYSIS OF GRAPHITE OXIDATION. G. Hennig (Argonne National Lab., Lemont, Ill.). p.265-71 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

A systematic study of hexagonal pitting in graphite single crystals was undertaken. It is shown that the initiation of pits depends upon several factors besides the presence of a suitable catalyst. By itself a catalyst such as iron, gold, silver, etc., did produce pits perpendicular to the carbon layers, but only etched figures in the direction of the carbon layers. In highly purified crystals, presumably free of catalytic impurities, the markings assumed preferred orientations during burning in oxygen. Preferential burning was suppressed by chlorine. Implication of these observations are discussed. (auth)

7371

THE REACTION OF CARBON WITH OXYGEN ATOMS. J. Streznewski and J. Turkevich (Princeton Univ., N. J.). p.273-8 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

Evaporated carbon films and carbon particles obtained by burning benzene in air were subjected to reaction with oxygen atoms produced in a discharge tube. The evaporated film reaction was followed using the optical transmission as a method of determining the rate of erosion of the surface. Rates of erosion of the surface were determined for atom concentrations up to 65%. The rate of erosion of the film is independent of temperature in the range 20 to 100°C and depends directly upon the oxygen atom concentration. The carbon black samples mounted on SiO films were also reacted with oxygen atoms and the change in size distribution was followed by the electron microscope. The means radius of the particles decreases linearly with time, the half-width of the particle size distribution remains constant. The rate is temperature independent and dependent directly on the concentration of oxygen atoms. Hydrogen atoms also react with carbon at room temperature while ozone shows no effect. (auth)

7372

NEW MOLECULAR COMPOUNDS OF GRAPHITE. R. C. Croft (Commonwealth Scientific and Industrial Research Organization, Melbourne). p.315-19 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

Theoretical consideration of experimental data indicates two criteria for intercalation in graphite. Electronic interaction between the cation of a proposed reactant and graphite must be possible, and the electron affinity of the cation must be sufficient to promote such interaction. These conditions are regarded as the basis of the remarkable specificity shown by graphite towards chlorides. The observation that intercalation depends on the electronic configuration of a cation and not on the anion associated with it accounts for the occlusion of various oxides and sulfides in graphite. Extension of the intercalation criteria for graphite by addition of the requirement that a host substance must be able to afford physical accomodation for foreign substances, leads to recognition of the possibility that hosts other than graphite may also show the intercalation phenomenon. The new lamellar compounds of crystalline boron nitride are given as an example. Various useful applications of graphite compound formation to both applied and fundamental problems are also discussed. (auth)

7373

STRUCTURE DETERMINATION OF GRAPHITE OXIDE. A. Clauss (European Research Associates, Brussels). p.321-8 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

Washing a freshly prepared graphite oxide in darkness with 5% aqueous hydrochloric acid saturated with chlorine dioxide gives a light-colored product which is unchanged on drying. This product has the same composition as the usual dark graphite oxide prepared from the same sample. On reaction with sodium hydroxide or with sodium ethoxide solution the light-colored graphite oxide turns dark. Both the dioxane method and the reaction with sodium ethoxide give a value of approximately 1100 mequiv hydroxyl groups/100 g. Some of the hydroxyl groups can be neutralized with aqueous or alcoholic alkali or methylated with diazomethane. The acid character of these interstitial hydroxyl groups indicates that they may be enolic. In the light-colored oxide most of the oxygen is probably in the keto form. Both saponification of the methylated product and methylation with methanol and hydrogen chloride show the presence of a small number of carboxyl groups. The layer spacing indicates that these are situated at the edges of the layers. Infrared absorption indicates the presence of hydroxyl and carboxyl groups. Based on these experiments a model structure which explains the properties of graphite oxide is presented. (auth)

7374

ELECTRONIC PROPERTIES OF THE CRYSTAL COMPOUNDS OF GRAPHITE. A. R. Ubbelohde (Imperial Coll., London. p. 329-35 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

The nature of the carbon bonds formed in crystalline compounds of graphite and the electronic properties that can be interpreted in terms of the bond structure are discussed. The effects in formation of addition compounds with the small aromatic and the macro-aromatic molecules in graphite are compared and contrasted. (C.J.G.)

7375

FIXATION OF BROMINE ON CARBONS OF VARIOUS DEGREES OF GRAPHITIZATION. J. Maire (Societe Le Carbone-Lorraine, Paris) and J. Mering (Laboratoire Central des Services Chimiques de l'Etat, Paris). p. 337-46 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959. (In French)

Studies of 30° isotherms and x-ray diagrams reveal the formation of two compounds, $C_{16}Br$ and C_8Br. On one

series of carbons (prepared between 1600 and 3000°C) a quantitative study with x rays led to a statistical description of the structure. A parallel study of the isotherm cycles led to the following conclusions with regard to localization of Br layers: the Br attaches in the graphite regions; also, there is fixation in the heterogeneities created by incipient graphitization. The maximum of this second fixation occurs in carbons which exhibit the Hall effect (prepared near 2000°C). Study of the "residual compounds" shows that these are made up of isolated layers of Cr of the same structure as those of $C_{16}Br$. (tr-auth)

7376

KINETICS OF THE GRAPHITE-BROMINE REACTION. J. G. Hooley (Univ. of British Columbia, Vancouver). p.347-8 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

A recording quartz spring balance is described, with which the course of any solid-gas reaction can be followed in the complete absence of air and at temperatures up to 500°C. It has a capacity of 10 g and a maximum usable sensitivity of 20 mV/mg. The absorption isotherms and rates of absorption of bromine vapor on graphite were measured. (auth)

7377

STUDIES ON PRODUCING GRAPHITIZABLE CARBONS. J. S. Conroy, R. S. Slysh, D. B. Murphy, and C. R. Kinney (Pennsylvania State Univ., University Park). p.395-403 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

Many substances when charred in the liquid state produce non-graphitizing carbons. 9,9-Bianthryl however produces a graphitizable char when heated under its own vapor pressure at 500°C. On heat treatment of this char at 1000°C, the average interlayer spacing grows and the crystallite height decreases; but at 3000°C, the d-spacing falls to near that of natural graphite and the crystallite height grows to about 1000 A. It is assumed that the mechanism of charring under these conditions involves mainly condensation of the aromatic molecules at their edges forming carbon sheets of two-dimensional structure. In the vapor state, in the range of 900 to 1400°C a wide variety of organic structures undergo pyrolysis to produce spherical carbon black like chars which are not completely graphitized even at 3000°C. However, if the vapor is impinged on solid surfaces at 900 to 1400°C, graphitizable carbons are produced, apparently from all types of organic compounds. These observations agree with the theory that at high temperatures fragmentation of the molecules occurs, producing fragments, which may have a structure independent of the source material (such as acetylene), and which condense either to droplets in the vapor stream or to films on solid surfaces. Further charring of these intermediates results in carbons which have quite different properties. X-ray parameters of these chars and carbons are discussed. (auth)

7378

CELLOPHASE PROTECTIVE STRIPS PREVENT DAMAGE TO RADIO PAPER-CHROMATOGRAPHIC STRIPS DURING EVALUATION. (to Frieseke & Hoepfner G.m.b.H). German Patent DBP 1,046,369. June 11, 1959. Atompraxis 5, 501(1959). (In German)

In the evaluation of radio electrophoretic and paper-chromatographic strips the filter strips serving as carrier of the radioactive precipitate are passed continuously or step-by-step by two radiation detectors by means of a suitable conveyer device. In the conveying the strips are placed under more or less mechanical stress which causes, especially in the cases when the strips are damp, considerable damage to the strips and necessitates repeated evaluation of the same strip. It is proposed to cover both sides of the strip with cellophane or some similar material. In this way damp filter paper strips could be evaluated directly, which is of special significance in fast blood investigation. Another advantage is that contamination of the apparatus by skinning on the structural parts is prevented. (J.S.R.)

7379

INHIBITING THE POLYMERIZATION OF NUCLEAR COOLANTS. E. L. Colichman (to U. S. Atomic Energy Commission). U. S. Patent 2,909,486. Oct. 20, 1959.

The formation of new reactor coolants which contain an additive that suppresses polymerization of the primary dissociation free radical products of the pyrolytic and radiation decomposition of the organic coolants is described. The coolants consist of polyphenyls and condensed ring compounds having from two to about four carbon rings and from 0.1 to 5% of a powdered metal hydride chosen from the group consisting of the group IIA and IVA dispersed in the hydrocarbon.

7380

NUCLEAR REACTOR COOLANT. E. L. Colichman (to U. S. Atomic Energy Commission). U. S. Patent 2,909,487. Oct. 20, 1959.

The formation of new reactor coolants which suppress polymerization resulting from pyrolitic and radiation decomposition is described. The coolants consist of polyphenyls and condensed ring compounds having from two to about four carbon rings and from 0.1 to about 10% of an alkali metal dispersed in the hydrocarbon.

7381

NUCLEAR REACTOR COOLANT. E. L. Colichman (to U. S. Atomic Energy Commission). U. S. Patent 2,909,488. Oct. 20, 1959.

The formation of new reactor coolants which suppress polymerization resulting from pyrolytic and radiation decomposition is described. The coolants consist of polyphenyls and condensed ring compounds having from two to about four carbon rings and from 0.1 to about 5% of beryllium or magnesium dispersed in the hydrocarbon.

7382

METHOD FOR PRODUCING ISOTOPIC METHANES FROM LITHIUM CARBONATE AND LITHIUM HYDRIDE. J. W. Frazer (to U. S. Atomic Energy Commission). U. S. Patent 2,910,519. Oct. 27, 1959.

A process is described for the production of methane and for the production of methane containing isotopes of hydrogen and/or carbon. Finely divided lithium hydride and lithium carbonate reactants are mixed in intimate contact and subsequently compacted under pressures of from 5000 to 60,000 psi. The compacted lithium hydride and lithium carbonate reactants are disposed in a gas collecting apparatus. Subsequently, the compact is heated to a temperature in the range 350 to 400°C whereupon a solid-solid reaction takes place and gaseous methane is evolved. The evolved methane is contaminated with gaseous hydrogen and a very small amount of CO_2; however, the desired methane product is separated from said impurities by well known chemical processes, e.g., condensation in a cold trap. The product methane contains isotopes of carbon and hydrogen, the isotopic composition being determined by the carbon isotopes originally present in the lithium carbonate and the hydrogen isotopes originally present in the lithium hydride.

Analytical Procedures

7383 AERE-C/M-37

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England].

THE USE OF T.T.A. FOR THE ESTIMATION OF PLUTONIUM IN TRACER QUANTITIES. G. N. Walton. Sept. 1949. 21p.

Existing available information about T.T.A. and its use is summarized. An analytical method is described for the estimation of the total plutonium in a sample under certain conditions and for the estimation of tetravalent plutonium, as distinct from the tri- or hexavalent states. Results for the procedures used are quoted, and the quilibria involved are discussed. (auth)

7384 CEA-1065

France. Commissariat à l'Énergie Atomique, Paris.

APPLICATION DE LA MICROANALYSE QUALITATIVE A LA DETERMINATION DES ESPECES SECONDAIRES D'URANIUM. (Applications of Qualitative Microanalysis to the Determination of Secondary Species Associated with Uranium). H. Agrinier. Feb. 1959. 37p.

Microanalytical techniques are described which allow rapid determinations of secondary species associated with uranium. They consist in exposing the constituent elements of the ores by means of characteristic microchemical reactions. Because of their rapidity and the small amount of apparatus needed, these techniques can be used either in the field or in the laboratory. (auth)

7385 CF-58-9-20

Oak Ridge National Lab., Tenn.

ALUMINUM DETERMINATION IN REACTOR COOLING WATER. J. F. Emery and G. W. Leddicotte. Sept. 9, 1958. 3p. OTS.

A method for determination of submicrogram quantities of Al in reactor cooling water by neutron activation analysis is described. Data obtained in analyses of samples from the ORR and the Bulk Shielding Reactor are included. (J.R.D.)

7386 CF-60-1-57

Oak Ridge National Lab., Tenn.

CHECK-OUT OF BETTIS DISSOLVED OXYGEN ANALYZER, MODEL 3. R. S. Greeley, P. D. Neumann, S. E. Bolt, and J. C. Griess. Jan. 14, 1960. 13p. OTS.

A Bettis Dissolved Oxygen Analyzer was constructed, calibrated, tested on 100A-loop D, and installed at the HRT. The analyzer was sensitive to less than 10 parts per billion of oxygen dissolved in water circulating at 200°C in 100A-loop D, gave readings in the 0.1 to 30 parts per million range in agreement with chemical analysis of the water, and appeared to be rugged, reliable, easy to use, and adaptable to automatic recording. A value of 22 parts per billion oxygen in the condensate from the HRT steam system was obtained with the reactor at 4.0 Mw, in agreement with Winkler method analysis. Operating instructions for the analyzer are included in an appendix. (auth)

7387 GAT-T-725

Goodyear Atomic Corp., Portsmouth, Ohio.

THE DETERMINATION OF TRACES OF VANADIUM IN THE PRESENCE OF AN EXCESS OF NICKEL. A. L. Cardenas. Jan. 14, 1960. 4p. Contract AT(33-2)-1. OTS.

A method for determination of V in the presence of excess Ni is presented. The method is based on the formation of phosphotungstovanadic acid and is sensitive to 1 γ V/g sample. Cr, Mo, or Ti do not interfere. (J.R.D.)

7388 HW-14337

Hanford Works, Richland, Wash.

THE IDENTIFICATION AND DETERMINATION OF TRACE AMOUNTS OF RARE EARTHS IN GRAPHITE BY NEUTRON ACTIVATION. A. M. Ross. Sept. 1, 1949. Decl. Jan. 29, 1960. 28p. Contract [W-31-109-Eng-52]. OTS.

The identification and quantitative determination of trace amounts of rare earths in graphite by neutron activation are described. The specific rare earth elements identified are europium and samarium. The half lives of Eu^{152} and Sm^{153} were determined as 9.32 ± 0.04 hours and 46.34 ± 0.23 hours, respectively. (auth)

7389 HW-61728

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

LIQUID SCINTILLATION SPECTROMETRY FOR THE ANALYSIS OF Zr^{95}–Nb^{95} MIXTURES AND COINCIDENCE STANDARDIZATION OF THESE ISOTOPES. J. Donald Ludwick. Aug. 31, 1959. 17p. Contract AT(45-1)-1350. OTS.

A method is reported which describes the simultaneous counting of the isobars zirconium-95 and niobium-95 in a liquid scintillation spectrometer. A method is also described for coincidence calibration of these isobars using the liquid scintillation method in order to further point out the utility of this technique. The shapes of the beta spectra from Zr^{95} and Nb^{95} in the liquid scintillator demonstrates the resolution of their beta particles. The weaker niobium beta particles show a maximum, lower in energy than 15% of the zirconium-95 beta spectrum. This allows simple simultaneous quantitative analysis of mixtures of these two isobars with comparative ease. This technique may readily be extended to mixtures of other beta emitters whose analysis is rendered difficult or tedious because of numerous experimental considerations. Samples of separated Zr^{95} and Nb^{95} were calibrated in a β–γ coincidence arrangement, utilizing the liquid scintillator to detect their beta particles. (auth)

7390 IEA/RQ-8

São Paulo, Brazil. Universidade. Instituto de Energia Atomica.

ANALISES POR ATIVAÇÃO. PARTE III. DETERMINAÇÃO SIMULTANEA DE OURO E URANIO NOS MINERAIS POR RADIOATIVAÇÃO. (Analysis by Activation. Part III. Simultaneous Determination of Copper and Uranium in Minerals by Radioactivation). Alcídio Abrão. Apr. 1959. 15p.

Copper and uranium frequently associated in the same mineral, can be qualitatively and quantitatively determined by means of the radioisotopes Au^{198} and Np^{239} formed during the irradiation of the mineral in a reactor. The copper is separated from the neptunium and fission products by anion resin without the addition of isotopic carriers. The efficiency of the chemical separation and the purity of the two radioisotopes is controlled by gamma spectroscopy and by determination of the half lives. (tr-auth)

7391 PGR-11(S)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Springfields, Lancs, England.

ANALYTICAL METHOD FOR THE SPECTROGRAPHIC DETERMINATION OF MAGNESIUM IN VANADIUM. Oct. 15, 1959. 9p. BIS.

A sulfuric acid solution of the sample is excited by a condensed spark. The spectra are recorded through a large quartz spectrograph, and the magnesium is evaluated by an intensity method using vanadium as internal standard. (auth)

7392 PGR-62(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHODS FOR THE INSPECTION OF AMMONIA LIQUOR. 1959. 18p. BIS.

The ammonia and the fluoride contents are determined titrimetrically. Boron, iron, phosphorus, and silicon are determined absorptiometrically, and the chloride content turbidimetrically. (auth)

7393 PGR-64(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHODS FOR THE INSPECTION OF ALUMINIUM NITRATE. 1959. 15p. BIS.

Water-insoluble matter and Al are determined gravimetrically. The total nitrate content is determined volumetrically, the chloride and sulfate turbidimetrically, and the boron and iron absorptiometrically. (auth)

7394 PGR-70(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHODS FOR THE INSPECTION OF HYDRAZINE MONONITRATE. 1959. 15p. BIS.

The assay, pH, and total nitrate are determined titrimetrically, the boron and iron content absorptiometrically, chloride turbidimetrically, and the sulfate gravimetrically. (auth)

7395 PGR-71(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHOD FOR THE INSPECTION OF BUTEX (BIS BB, BUTOXY ETHYL ETHER). 1959. 25p. BIS.

The acetaldehyde equivalent, acidity, chlorine, and hydroxy- and unsaturated compounds are determined titrimetrically, and the boron and total peroxides absorptiometrically. Water, distillation range, specific gravity, viscosity and sulfated residue are determined by conventional techniques. (auth)

7396 PGR-80(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHODS FOR THE INSPECTION OF SULPHAMIC ACID. 1960. 16p. BIS.

The total acidity and amino group are determined titrimetrically and the boron absorptiometrically. The chloride content is measured turbidimetrically, the phosphorus by visual colorimetry, and the total sulfur, sulfate, residue on ignition, volatile matter, and water insoluble matter gravimetrically. (auth)

7397 Y-1259(Rev.)

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

THE SPECTROGRAPHIC DETECTION OF TRACE IMPURITIES IN BERYLLIUM OXIDE. O. P. Killeen. Jan. 28, 1960. 12p. Contract W-7405-eng-26. OTS.

Methods are reported for the spectrographic determination of trace impurities in beryllium oxide. The detected elements include most of the Type 4F rare earths and 20 common elements. The observed detection limit for each element is reported. (auth)

7398

DETERMINATION OF BORON IN BERYLLIUM, ZIRCONIUM, THORIUM, AND URANIUM. DISSOLUTION IN BROMINE-METHANOL. A. R. Eberle and M. W. Lerner (U. S. Atomic Energy Commission, New Brunswick, N. J.). Anal. Chem. 32, 146-9(1960) Feb.

Boron in metals can be determined by dissolution of the metal in bromine-methanol, followed by distillation of the boron ester and color development with diaminochrysazin. With the anhydrous reaction mixture, traces of boron can be completely recovered by a partial distillation. The procedure, applied to boron determination in Be, Th, U, Zr, and Zircaloy yielded excellent precision and accuracy. (auth)

7399

DETERMINATION OF URANIUM(VI) BY REDUCTION TO URANIUM(III) IN A JONES REDUCTOR. John H. Kennedy (E. I. du Pont de Nemours and Co., Inc., Wilmington, Del.). Anal. Chem. 32, 150-2(1960) Feb.

Uranium solutions can be analyzed accurately by reducing uranium(VI) quantitatively to uranium(III) in a Jones reductor and then titrating it with potassium dichromate. The reduction is quantitative in 1M hydrochloric or 1M perchloric acid medium if the uranium solution is more dilute than 0.01M. The effluent is caught in a deaerated solution of iron(III), which is reduced by the uranium(III) to iron(II), which is then titrated with potassium dichromate. (auth)

7400

DETERMINATION OF IODINE IN THALLIUM(I) IODIDE PRECIPITATES. Edward Jeung and E. H. Huffman (Univ. of California, Berkeley). Anal. Chem. 32, 152-3(1960) Feb.

A method for the determination of iodine in thallium(I) iodide precipitates is based on the observation that thallium(I), as well as iodide, can be quantitatively oxidized by bromine at pH 5 and that thallium(III) is not reduced by formic acid in the Kainrath method for iodine determination. Thallium(III) subsequently liberates iodine, as does the iodate, by reaction with potassium iodide. (auth)

7401

RADIOASSAY OF FINELY DIVIDED SOLIDS BY SUSPENSION IN A GEL SCINTILLATOR. Samuel Helf, C. G. White, and R. N. Shelley (Picatinny Arsenal, Dover, N. J.). Anal. Chem. 32, 238-41(1960) Feb.

The counting of radioactive materials as suspensions in a gel scintillator is described. The radioelements included in the suspended samples are strontium-90–yttrium-90, chlorine-36, sodium-22, barium-133, nickel-63, carbon-14, and hydrogen-3. Factors affecting suspension counting efficiency are discussed and a comparison is made with homogeneous solution counting for some specific cases. (auth)

7402

DIRECT-READING SPECTROCHEMICAL DETERMINATION OF FLUORINE IN ALUMINA. P. E. Lemieux and R. H. Black (Aluminum Labs., Ltd., Arvida, Quebec). Anal. Chem. 32, 246-8(1960) Feb.

Direct-reading spectrochemical instrumentation was applied to the determination of fluorine in calcined alumina. The sensitivity and reproducibility of two CaF and one SrF band heads were compared, using a variety of mixtures and excitation conditions, including a helium atmosphere. A Quantometer was used for development work. Best results are obtained with a mixture of equal parts of sample, strontium carbonate, and graphite, ex-

cited in air by a 6-amp direct-current arc. The secondary SrF band head at 5782 A provides a limit of detection of about 0.006%. In the 0.0 to 0.5% range, the standard deviation relative to chemical values is less than 0.02% fluorine. The analytical time is less than 20 man-minutes per sample. Comparable results are obtained with a Hilger medium quartz direct reader. (auth)

7403

THE VOLUMETRIC DETERMINATION OF URANIUM AFTER REDUCTION BY LEAD IN DILUTE PERCHLORIC ACID SOLUTION. T. W. Steele (Univ. of Witwatersrand, Johannesburg). Analyst 85, 55-62(1960) Jan.

A rapid and convenient volumetric method is described for determining uranium which is suitable for high-grade ores and oxide concentrates. A dilute boiling solution of the sample in perchloric acid is reduced with granular lead and cooled under an atmosphere of carbon dioxide. After decanting the solution and adding ferric perchlorate, it is titrated with standard potassium dichromate solution. The elements found to interfere can be removed by precipitation with cupferron in the perchloric acid solution. The results obtained for uranium oxide samples by the proposed method are compared with those by a standard gravimetric method. (auth)

7404

THE RADIOMETRIC DETERMINATION OF HAFNIUM IN ZIRCONIUM. Nikola Getoff. Atompraxis 5, 472-4(1959). (In German)

The radiometric determination of hafnium as an impurity in zirconium and vice versa is discussed. The limit of detection in activation analysis of Hf and Zr with thermal neutrons is discussed, and data on the use of Hf^{181} as a radioindicator are given, together with an example. (auth)

7405

A NEW METHOD FOR THE DETERMINATION OF O^{18} IN ORGANIC COMPOUNDS. H. Dahn and H. Moll (Universitat, Basel, Switzerland). Chem. & Ind. (London) No. 12, 399-400(1959) Mar. 21.

A method for the determination of oxygen-18 in organic compounds with o-phenylenediamine monohydrochloride as the conversion reagent is given. The reagent reacts with the oxygen to give either Schiff bases or benzimidazoles and water which are then equilibrated with inactive CO_2. Agreement between experimental and calculated results is satisfactory. (C.J.G.)

7406

ON THE EVAPORATION OF UF_6 FROM CHLOROFLUOROBUTANES. F. I. Havliček, M. Modesto, and J. Strle (Institut J. Stefan, Ljubljana, Yugoslavia). Energia nucleare (Milan) 7, 53(1960) Jan. (In English)

Experiments on evaporation of UF_6 from a 1:1 mixture of $C_4Cl_2F_8$ and $C_4Cl_3F_7$ at 35°C are briefly reported which show a U^{238}–U^{235} separation factor of 1.0001. (T.R.H.)

7407

COLORIMETRIC DETERMINATION OF HAFNIUM AND ZIRCONIUM IN THEIR MIXTURES. E. Cerrai and C. Testa (Centro Informazioni Studi Esperienze, Milan). Energia nucleare (Milan) 7, 53-4(1960) Jan. (In Italian)

A method for determining Hf or Zr in the presence of the other is described. The method is based on the different behavior of the two elements in oxygenated water in the presence of xylenol orange. The absorption maximum for Hf and Zr occurs at 535 mμ, but addition of oxygenated water changes the Zr maximum by a factor of 6 but the Hf maximum changes only by 1.6 (T.R.H.)

7408

EFFECT OF SPECIMEN DELOCALIZATION IN ELECTRON DIFFRACTION STUDIES OF GAS MOLECULES. L. S. Bartell (Iowa State Coll., Ames). J. Appl. Phys. 31, 252-4(1960) Feb.

The effect upon a normal electron-diffraction pattern of an extraneous uniform distribution of the gaseous specimen is considered quantitatively. It is shown that the delocalization of gas may lead to errors in internuclear distances of several thousandths of an Angstrom unit or more in conventional experiments. Equations are presented for the correction of experimental data. (auth)

7409

ON THE ANALYSIS OF HYDROGEN FLUORIDE IN FLUORINE BY DIELECTRIC CONSTANT METHOD. R. Ukazi and I. Kageyama (Osaka Metal Ind. Co.). J. Atomic Energy Soc. Japan 1, 359-62(1959). (In Japanese)

The relationship between the hydrogen fluoride content in fluorine and the electric capacity change measured by variable condenser was theoretically derived from Debye's formula concerning molecular polarization. The sample condenser was made of poly tetrafluoroethylene resin. Its terminal was platinum, and the electric capacity was 200 pf. The liquid nitrogen and mercury method was used for the chemical analysis of hydrogen fluoride and fluorine in the samples. Concerning the relationship between the hydrogen fluoride content (ω wt.%) and the electric capacity change (ΔCpf), the following equation was obtained; $\Delta C = 4.3 \pm 10^{-2}\omega$. The electric capacity of the variable condenser was 300 pf and the experimental accuracy was 0.06 pf. (auth)

7410

PRACTICAL PERFORMANCE OF AN ACTIVATION ANALYSIS: CHLORINE DETERMINATION IN ZINC SULFIDE. F. Baumgärtner (Technische Hochschule, Munich). Kerntechnik 1, 183-7(1959) Dec. (In German)

The method used in the chemical laboratory of the Munich Research Reactor for the determination of chlorine in zinc sulfide by activation analysis is given in detail. (J.S.R.)

7411

A SIMPLE METHOD FOR THE DETERMINATION OF THE CESIUM-137 CONTENT OF PRECIPITATIONS. A. Dannecker, H. Kiefer, and R. Maushart (Kernreaktor Bau- und Betriebs-Gesellschaft m.b.H., [Karlsruhe, Ger.]). Kerntechnik 1, 187-9(1959) Dec. (In German)

A method, which combines the enrichment and separation of Cs^{137} by coprecipitation and adsorption with the measurement of the 0.66-Mev gamma line, is described for the rapid determination of the Cs^{137} content of precipitations. The detection range is 5×10^{-11} c, so that approximately 10 to 20 liters of precipitation are necessary. The main advantage is that the method can be carried out in the same operation as the determination of the total activity of the precipitation. The total time for analysis is about 150 min. (tr-auth)

Radiation Chemistry

7412 AD-213267

General Mills, Inc., Minneapolis.

A STUDY OF THE EFFECTS OF IONIZING RADIATION ON SUGARS. Report No. 4 (Progress) [for] April 1, 1958-September 30, 1958. J. S. Andrews. 17p. Project No. 7-84-01-002. Contract QMRE E (Natick) No. 78.

Experiments on the cellophane-dye dosimeter to measure the anomalous high dose in a product near the wall of a tin can are described. A cobalt-60 source was used. No surface burn effect was demonstrated within 3% probable

error of the individual dosimeters. Experiments in which a spent fuel rod was used showed an increase in dose over that which would have been present were the can wall removed. This surface burn extends into the media with a tenth value depth of approximately 0.02 gm/cm^2. Partial separation of the irradiation products of glucose from unchanged glucose in irradiated solutions was accomplished by adsorption on activated charcoal and by formation of lead salts. Tests indicate the presence of at least five non-glucose fractions obtained by each of these techniques. (For preceding period see AD-210342.) (J.R.D.)

7413 AF-SAM-60-2

Albert Einstein Medical Center. Radiology Dept., Philadelphia.

PROTEIN BINDING OF AET AND ITS ALTERATION BY IONIZING RADIATION. E. Anne Dickens and Bernard Shapiro. July 9, 1959. 12p.

The addition of carbon-14-labeled 2-mercaptoethylguanidine–guanidoethyl disulfide (MEG-GED) solutions to protein solutions results in binding of a radioactive species to the protein. This protein-bound species cannot be removed by dialysis or paper chromatography but is displaced to varying extents by thiols, guanidine, and ethylamine. Displacement of the radioactivity from the protein results in formation of products which indicate that the protective agent is bound in the MEG form. The binding is attributed both to mixed disulfide formation with protein sulfhydryl and disulfide groups and to hydrogen bonding between the carboxylate and hydroxyl groups of the protein and the guanido portion of the protective agent. The amount of radioactivity bound by the protein increases when the protein-MEG-GED solutions are allowed to stand at room temperature or are irradiated with cobalt-60 gamma rays. These findings do not support the theory that radiation protection is due to splitting of the protective agent-protein disulfide bond. (auth)

7414 WADC-TR-59-296

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

RADIATION CHEMISTRY AND RELATED PHENOMENA. PART I. MECHANISMS OF RADIATION CHEMISTRY. Gordon G. Wepfer. PART II. RADIATION CHEMISTRY OF SATURATED ALIPHATIC HYDROCARBONS. Lowell A. King. PART III. RADIATION CHEMISTRY AS A PRECURSOR TO RADIATION EFFECTS ANALYSES. William L. R. Rice. [Period covered] April 1959 to June 1959. June 30, 1959. 90p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: RADIATION EFFECTS AND MEASUREMENTS. OTS.

It is known that when high-energy radiation passes through matter, energy is transferred to the target by ionization and excitation processes. Subsequently, any number of processes can and do occur, depending on the ionization density. Part I of this report is a summary of the mechanisms which can take place leading to the observed effects in radiation chemistry studies. The discussion is limited somewhat by a lack of knowledge of the extent to which the various secondary processes take place in a given system. It is possible, however, to discuss things which have been observed and the conditions under which certain processes are known to take place, processes which should be considered in studying any new system. Part II is a review of the radiation chemistry of pure saturated aliphatic hydrocarbons. Discussions and experimental observations found in the literature have been condensed and are presented. Part III is concerned with gross property changes resulting from interaction of radiation with materials. Programs to date in the radiation effects area are discussed. The relative success or failure of these various research efforts is indicated. An attempt is made to show the need for correlation of fundamental changes observed through radiation chemistry, and macroscopic changes observed in radiation effects studies. (auth)

7415 CEA-tr-I-24

IDENTIFICATION ET SÉPARATION CHROMATOGRAPHIQUE DES PRODUITS OBTENUS DE LA PHÉNYLALANINE PAR IRRADIATION AVEC DES NEUTRONS LENTS. (Identification and Chromatographic Separation of Products Obtained from Phenylalanine by Irradiation with Slow Neutrons). R. Barbieri, U. Belluco, and M. Bruno. Translated into French by L. Roulet from Gazz. chim. ital. 87, 1377-92(1957). 33p.

The products from slow-neutron irradiation of phenylalanine were identified and determined. After separation by paper chromatography and silica gel and ion exchange resin columns, products containing C^{14} from $N^{14}(n,p)$ reactions were studied. Polymers, organic acids, and amino acids were found. The ease of oxidation of free radicals formed was indicated Emphasis was placed on the various methods and techniques for studies of this type. (T.R.H.)

7416

OXIDATION OF AQUEOUS SOLUTIONS OF OXYHEMOGLOBIN UNDER γ IRRADIATION. Fayed Afifi, Moise Haissinsky, and Jacques Pucheault Compt. rend. 250, 118-20(1960) Jan. 4.

A study was made of the initial yields from oxidation of oxyhemoglobin (Fe^{2+}) to methemoglobin (Fe^{3+}) in aqueous solution irradiated by Co^{60} gamma rays. The prolonged effect of this oxidation was also studied as a function of pH and concentration. (tr-auth)

7417

ADDITION REACTIONS INITIATED BY RADIATION. ADDITION OF CARBON TETRABROMIDE TO STYRENE. Guy Rabilloud and Philippe Traynard (l'Institut Francais des Petroles, Grenoble, France and Centre d'Etudes Nucleaires, Grenoble, France). Compt. rend. 250, 334-6(1960) Jan. 11. (In French)

The irradiation of a very dilute solution of styrene in tetrahalomethanes causes addition of free radicals created in the solvent to the olefinic double bond. The mechanism is that of the classic chain reaction, certain characteristics of which were studied. (tr-auth)

7418

ENERGY TRANSFER IN POLYETHYLENE AND POLYETHYLENE-POLYBUTADIENE MIXTURES DURING GAMMA IRRADIATION. Malcolm Dole and T. F. Williams (Northwestern Univ., Evanston, Ill. and Atomic Energy Research Establishment, Harwell, Berks, Eng.). Discussions Faraday Soc. No. 27, 74-82(1959).

Disappearance of initial vinyl or vinylene unsaturation on gamma-ray irradiation of highly crystalline linear polyethylenes follows a first-order decay law in the liquid state, but only over a limited dose range in the solid. Evidence is given that this decay must be the result of transfer of energy of excitation within localized spurs. Breakdown of the first-order law in the solid state when a certain concentration of radiolytically and randomly produced vinylene groups is explained on the basis of a protective action of the latter. Concentrations of cis- or trans-1:4-polybutadiene up to 5% exhibited little effect on the radiolysis of crystalline polyethylene in the polyethylene + polybutadiene mixture, but in the liquid state the polybutadiene must interact both with ions and excited

states of the polyethylene because $G(H_2)$ and k_1, the vinyl group decay constant, are both lowered markedly. cis-Polybutadiene exerts less of a protective action than trans-polybutadiene. The difference between the behavior in the liquid and solid states is explained on the basis of a more uniform distribution of the polybutadiene in the liquid and a greater frequency of collisions between the polybutadiene segments and ions or excited groups of the polyethylene. (auth)

7419

OXIDATION OF HYDROCARBONS IN LIQUID PHASE UNDER RADIATION. Roger Montarnal (Institut Français du Pétrole, Cherbourg, France). Énergie nucléaire 1, 282-8(1959) Nov.-Dec. (In French)

After a brief statement of the principle of the chemical effects of radiation, and a report of the first work done on chain reactions, the advantages are pointed out of using radiation in these reactions and in more complex oxidation phenomena which depend, in certain conditions, on a chain mechanism. Radiation can be used in liquid-phase hydrocarbon oxidation by molecular oxygen to obtain more selective conditions by well-defined initiation at low temperatures. Radiation is also useful in kinetic studies of oxidation reactions. (T.R.H.)

7420

REMARKS ON THE EFFECTS OF RADIATION ON CERTAIN ELEMENTS SUCH AS CARBON, NITROGEN, AND OXYGEN. Marie Ader (Collège de France, Paris). J. phys. radium 20, 983-4(1959) Dec. (In French)

Alpha particles from a Po source and from a 10-Mev beam were used to bombard polystyrene, C, N, and O. The results are tabulated for both energies as proton energy and path length. (T.R.H.)

7421

EFFICIENT FLASH PHOTOLYSIS SYSTEM. R. J. Charlson and Halstead Harrison (Stanford Univ., Calif.). and R. Hardwick (Univ. of California, Los Angeles). Rev. Sci. Instr. 31, 46-8(1960) Jan.

A flash tube of annular design, improved flash circuitry, and a photomultiplier enabler circuit are described. Results obtained with this apparatus indicate that the system quickly delivers a large number of photons into an absorption cell (viz., $\sim 6 \times 10^{16}$ photons/cc with about 5 μsec 1/e time and 50 μsec total decay time) and is thus suited for studies of fast photochemical kinetics. (auth)

7422

ON THE MAGNETOCHEMICAL DOSIMETRY OF GAMMA-RAYS. Shigeto Yamaguchi and Hiroshi Takeshita. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 53, 271-3 (1959) Dec. (In English)

An aqueous $Fe^{2+}-Fe^{3+}$ solution obtained from Mohr's salt solution, when irradiated by gamma rays, shows the characteristic magnetic property. The content of ferromagnetic precipitate (Fe_3O_4) formed is proportional to the gamma dose. The formation of spinel-type iron oxide in a $Fe^{2+}-Fe^{3+}$ solution is hindered in the presence of organic compounds. (auth)

7423

STUDIES ON CHEMICAL CHANGE IN RADIOLYSIS. III. THE ACTION OF GAMMA-RAYS ON AQUEOUS SOLUTION OF OXALIC ACID. Masao Matsui. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 53, 290-9(1959) Dec. (In English)

As preliminaries of the study for preparing oxalic acid by ionizing radiation, the stability of aqueous solutions of the acid against Co^{60} gamma rays is examined. A definite relationship between decomposition and total dose was found. Therefore, experiments were made for the purpose of applying oxalic acid to chemical dosimetry. (auth)

Radiochemistry

7424 CEA-tr-I-25

CHARACTÉRISTIQUES GÉNÉRALES ET ÉQUIPEMENT D'UN LABORATOIRE DE RADIOCHIMIE. (General Characteristics and Equipment of a Radiochemical Laboratory). F. Gadda and A. Scaroni. Translated into French by L. Roulet from Energia nucleare (Milan) 4, 379-90(1957). 36p.

The fundamental rules relative to construction and management of a low-level radiochemistry laboratory are pointed out. Equipment location, work-area disposition, and safety standards are reviewed. Generalities with regard to cost are made. (T.R.H.)

7425 CEA-tr-R-772

SÉPARATION DES ISOMÈRES NUCLÉAIRES. (Separation of Nuclear Isomers). A. S. Krivokhatskii (Krivokhatzsky). Translated into French from Uspekhi Khim. 24, 302-12 (1955). 26p.

Nuclear isomers are defined and discussed preliminary to description of separation methods. Chemical techniques and their mechanisms and temperature effects are reviewed, and a table of nuclear isomers is included. (T.R.H.)

7426

SOLID-COUNTING OF OCTADECANE-1-H^3. Mitsuo Muramatsu and Tsunetaka Sasaki (Tokyo Metropolitan Univ.). Science 131, 302-3(1960) Jan. 29.

A solid sample of octadecane-1-H^3 was found to show a fairly good proportionality of the counting rate to the amount of the sample. No memory effect was observed. (auth)

7427

METHOD FOR THE RECOVERY AND PURIFICATION OF BERKELIUM. E. K. Hulet (to U. S. Atomic Energy Commission). U. S. Patent 2,909,405. Oct. 20, 1959.

A solvent extraction process is described for the separation of berkelium from a mixture of elements in the lanthanum and actinium series of the periodic table. In particular, the mixture of elements is dissolved in 1.0N nitric acid, and the resulting solution is extracted with n-tributyl phosphate containing a stoichiometric excess of solid sodium bismuthate. The berkelium present in the nitric acid solution is oxidized to the IV oxidation state and is preferentially extracted into the n-tributyl phosphate. The organic phase, containing berkelium in an oxidized state, is extracted with 0.1N hydrochloric acid solution containing a small quantity of a reducing agent such as hydrazine hydrochloride. The berkelium is reduced to the III oxidation state and is extracted into the aqueous phase. The berkelium is then recovered from the aqueous phase.

7428

PLUTONIUM–HYDROGEN REACTION PRODUCT, METHOD OF PREPARING SAME AND PLUTONIUM POWDER THEREFROM. S. Fried and H. L. Baumbach (to U. S. Atomic Energy Commission). U. S. Patent 2,915,362. Dec. 1, 1959.

A process is described for forming plutonium hydride powder by reacting hydrogen with massive plutonium metal at room temperature and the product obtained. The plutonium hydride powder can be converted to plutonium powder by heating to above 200°C.

7429

METHOD OF OXIDIZING PLUTONIUM ION WITH BIS-

MUTHATE ION. C. S. Garner (to U. S. Atomic Energy Commission). U. S. Patent 2,917,362. Dec. 15, 1959.

A method is presented for oxidizing plutonium from the tetravalent state to the hexavalent state by means of bismuthate oxidizing agents.

Raw Materials and Feed Materials

7430 CCCO-557

Catalytic Construction Co., Philadelphia.

PROCESS ENGINEERING REPORT ON REVISED PROCESS DESIGN TRANSMITTAL, GREEN SALT PLANT, JOB NO. 3004 OF THE FEED MATERIALS PRODUCTION CENTER, FERNALD, OHIO. Specification Contract No. 3000, Part XXV, Section 4. George V. Holby and Floyd James. June 1, 1952. Decl. Oct. 7, 1959. 22p. Contract AT(30-1)-1060. OTS.

Process design information concerning equipment and operation of a plant to produce UF_4 from UO_3 is presented. Included are process flow diagrams, drawings of ventilation and dust control systems, and vent gas systems. Equipment lists and estimated utilities are also included as well as a description of the process. (J.R.D.)

7431 CEA-1083

France. Commissariat à l'Énergie Atomique, Paris.

MINERAIS DES BOIS NOIRS CONCENTRES DE MILIEU DENSE. (Dense Medium Ore Concentrates of Bois-Noirs). J. Le Bris and M. Leduc. 1959. 38p.

The chemical treatment of uranium concentrates of Bois-Noirs ore obtained by heavy medium are discussed. The first part deals with sulfuric acid attack on the concentrate, and the second part with the separation of the solution from residues by filtration. A third part deals with this separation by decantation. The fourth part deals with the carbonation of the pickling solutions obtained. (auth)

7432 NP-8306

Eldorado Mining and Refining Ltd. Research and Development Div., Ottawa.

RESEARCH AND DEVELOPMENT REPORT FOR DECEMBER 1959. 55p. (R59-12).

New Processes. Data were obtained on chlorination of Beaverlodge mill feed at different CCl_4–N_2 ratios and retention times. Solvent-in-pulp extraction tests at two levels of free acid showed generally lower amine losses in solids at the higher acid level. In continuous NH_3 precipitation of U from NH_4Cl strip liquors, sulfate concentration in the product was in the order of 2 to 3%. Apparatus was set up for reduction of uranous sulfate powders to UO_2 in quantities sufficient for sintering studies on a limited scale. Process Development. An extensive program of laboratory Pachuca leaching tests was started to investigate air diffusion, oxygen enrichment, and oxidant additives in carbonate leaching. Excellent results were obtained in plant tests of a glass wool horizontal bed coalescer for removal of entrained water from refinery organic streams. Tests have shown that MgF_2 slag can be leached successfully in ferric nitrate–sodium chlorate solution. A green density of 5.08 g/cc was obtained on a UO_2 powder prepared from urea-precipitated ADU. A program is under way to determine optimum conditions for pressing and sintering nuclear-grade UO_2 produced by different techniques. (For preceding period see NP-8220.) (W.L.H.)

7433 NP-8327

[Eldorado Mining and Refining Ltd.]. Research and Development [Div.], Port Hope, Ont.

GREEN SALT AND METAL RESEARCH MONTHLY REPORT [FOR] DECEMBER 1959. M. W. Melvanin, R. J. McClure, and T. W. Zawidzki. 8p.

Inspection of the Type III rods as rolled at the 0.328-in. stage indicated 58% of the rods had major defects; results are tabulated. Hardness tests on these rods gave an average value of 94.5 R_b. Addition of carbon as Na_2CO_3 in metal reduction charges produced inconsistent results; further investigation is planned. Investigation of anticaking compounds is being investigated for use in fabrication of UO_2. Data on the effects of the additive on the properties of ceramic UO_2 are given. Data on physical properties of ceramic UO_2 such as Blaine number, agglomerate size, and green densities are given along with information on density of UO_2 from the vertical reactor. (J.R.D.)

7434 NP-8328

[Eldorado Mining and Refining Ltd.]. Research and Development [Div.], Port Hope, Ont.

GREEN SALT AND METAL RESEARCH MONTHLY REPORT [FOR] JANUARY 1960. F. W. Melvanin, R. J. McClure, and T. W. Zawidski. 3p.

Flowsheets for production of 0.328- and 0.312-in. Type III rods are presented. Samples of the ADU from which low-density UO_2 was obtained are being investigated. Data on properties of UO_2 obtained from area precipitated ADU are given. The powder had a good general appearance and was free flowing; however, one sample contained a porous unidentified material. X-ray analysis is being conducted on this material. (For preceding period see NP-8327.) (J.R.D.)

7435

THERMODYNAMICS OF THE REDUCTION OF URANIUM TETRAFLUORIDE BY MAGNESIUM. I. M. Dubrovin and A. K. Evseev. Atomnaya Energ. 7, 379-82(1959) Oct. (In Russian)

The system of condensed phases (of uranium, magnesium fluoride, uranium fluoride) and magnesium vapor is considered monovariant at 1400°C (the temperature of magnesium thermal reduction). The phase transitions of magnesium melting at 923°K, α uranium transition to β uranium at 938°K, β uranium transition to γ uranium at 1045°K, melting of UF_4 at 1309°K, boiling of magnesium at 1376°K, melting of uranium at 1406°K, and melting of MgF_2 at 1536°K were considered in determining the variations of reaction free energy. The magnesium reduction of UF_4 at 1400°C results in metallic uranium and MgF_2 (the magnesium vapor pressure at 1400°C is 0.8 mm mercury). With magnesium abundance (0.5 to 10%) in the charge, the vapor pressure at 1400°C is 8 atm. The separation of uranium from MgF_2 is achieved by volatilization of magnesium and UF_4 (UF_4 boiling temperature 1417°). (R.V.J.)

7436

CONTINUOUS PROCESS FOR THE CONVERSION OF UF_6 TO UF_4. S. H. Smiley, D. C. Brater, and R. H. Nimmo (to U. S. Atomic Energy Commission). U. S. Patent 2,907,629. Oct. 6, 1959.

A method is presented for reducing UF_6 to UF_4 with hydrogen. A preheated mixture of UF_6 and fluorine is contacted with a stoichiometric excess of preheated hydrogen in a reaction chamber thereby producing UF_4. The UF_6 reacts quantitatively and the UF_4 produced is of high purity and high density.

7437

PREPARATION OF URANIUM HEXAFLUORIDE. S. Lawroski, A. A. Jonke, and R. K. Steunenberg (to U. S. Atomic Energy Commission). U. S. Patent 2,907,630. Oct. 6, 1959.

A process is described for preparing uranium hexafluoride from carbonate-leach uranium ore concentrate. The briquetted, crushed, and screened concentrate is reacted with hydrogen fluoride in a fluidized bed, and the uranium tetrafluoride formed is mixed with a solid diluent, such as calcium fluoride. This mixture is fluorinated with fluorine and an inert diluent gas, also in a fluidized bed, and the uranium hexafluoride obtained is finally purified by fractional distillation.

7438

MANUFACTURE OF UF_4. W. S. Calcott (to U. S. Atomic Energy Commission). U. S. Patent 2,908,548. Oct. 13, 1959.

The manufacture of uranium tetrafluoride from uranium dioxide is described. Uranium dioxide is heated to about 500°C in a reactor. Anhydrous hydrogen fluoride is passed through the reactor in contact with uranium dioxide for several hours, the flow of hydrogen fluoride is discontinued, and hydrogen passed through the reactor for less than an hour. The flow of hydrogen fluoride is resumed for several hours, and then nitrogen is passed for a few minutes to expel unreacted hydrogen fluoride as water vapor. The reactor is cooled to room temperature and the uranium tetrafluoride removed.

7439

PROCESS FOR PRODUCTION OF PLUTONIUM FROM ITS OXIDES. S. I. Weissman, M. L. Perlman, and D. Lipkin (to U. S. Atomic Energy Commission). U. S. Patent 2,908,563. Oct. 13, 1959.

A method is described for obtaining a carbide of plutonium and two methods for obtaining plutonium metal from its oxides. One of the latter involves heating the oxide, in particular PuO_2, to a temperature of 1200 to 1500°C with the stoichiometrical amount of carbon to form CO in a hard vacuum (3 to 10 microns Hg), the reduced and vaporized plutonium being collected on a condensing surface above the reaction crucible. When an excess of carbon is used with the PuO_2, a carbide of plutonium is formed at a crucible temperature of 1400 to 1500°C. The process may be halted and the carbide removed, or the reaction temperature can be increased to 1900 to 2100°C at the same low pressure to dissociate the carbide, in which case the plutonium is distilled out and collected on the same condensing surface.

7440

METHOD OF PREPARING UF_6. R. Davidson and S. Fried (to U. S. Atomic Energy Commission). U. S. Patent 2,910,344. Oct. 27, 1959.

A method is described of preparing uranium hexafluoride without the use of fluorine gas by reacting uranium tetrafluoride with oxygen gas under rigorously anhydrous conditions at 600 to 1300°K within a pre-fluorinated nickel vessel.

7441

METHOD OF PREPARING PLUTONIUM TETRAFLUORIDE. R. L. Beede and H. H. Hopkins, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,913,307. Nov. 17, 1959.

Crystalline plutonium tetrafluoride is precipitated from aqueous up to 1.6 N mineral acid solutions of a plutonium (IV) salt with fluosilicic acid anions, preferably at room temperature. Hydrogen fluoride may be added after precipitation to convert any plutonium fluosilicate to the tetrafluoride and any silica to fluosilicic acid. This process results in a purer product, especially as to iron and aluminum, than does the precipitation by the addition of hydrogen fluoride.

7442

METHOD OF PRODUCING PLUTONIUM TETRAFLUORIDE. W. B. Tolley and R. C. Smith (to U. S. Atomic Energy Commission). U. S. Patent 2,917,360. Dec. 15, 1959.

A process is presented for preparing plutonium tetrafluoride from plutonium(IV) oxalate. The oxalate is dried and decomposed at about 300°C to the dioxide, mixed with ammonium bifluoride, and the mixture is heated to between 50 and 150°C whereby ammonium plutonium fluoride is formed. The ammonium plutonium fluoride is then heated to about 300°C for volatilization of ammonium fluoride. Both heating steps are preferably carried out in an inert atmosphere.

Separation Processes

7443 AECU-4631

Massachusetts Inst. of Tech., Cambridge.

EQUILIBRIUM EXTRACTION CHARACTERISTICS OF ALKYL AMINES AND NUCLEAR FUELS METALS IN NITRATE SYSTEMS. Quarterly Progress Report No. V for the Period July 1–September 30, 1959. Edward A. Mason and Victor C. Vaughen. Dec. 4, 1959. 22p. For [Oak Ridge National Lab.] under Contract W-7405-eng-26, Subcontract 1327. OTS.

Extraction of HNO_3 by trilauryl amine was studied by equilibrating equal volumes of aqueous and organic phases at 25°C. At HNO_3 concentrations of 2 to 10 N the acid in the organic phase in excess of that equivalent to the amine concentration was proportional to the concentration of HNO_3 in the equilibrated aqueous phase. Other workers report similar results with nitric acid and tri-n-octyl amine in benzene. Zirconium extractions carried out at 10g Zr/l with 0.35 M TLA nitrate in toluene showed a fourth power dependence of E_A^0Zr on HNO_3 (aq) over the range 2 to 10N. Maximum distribution ratios calculated from samarium scouting experiments using amines in kerosene were about 5×10^{-3} for Primene JMT, 10^{-4} for TLA, 10^{-5} for S-24, and less than zero for DTDA. Distribution ratios in Ru extractions ranged from E_A^0 Ru = 0.12 for 0.35M TLA shaken with an initially new 2N HNO_3 solution for twenty four hours, to E_A^0 Ru = 0.0018 for 0.1M TLA shaken with new 8N HNO_3 solution for fifteen minutes. Data on Zr and Ru standardization in TLA solution for spectrophotometric analyses are included. (For preceding period see AECU-4351.) (J.R.D.)

7444 CEA-1082

France. Commissariat à l'Énergie Atomique, Paris.

ETUDE DU COMPORTEMENT DE LA RESINE AX-55 POUR LA RECUPERATION DE L'URANIUM DES SOLUTIONS D'ATTAQUE SULFURIQUE DE MINERALS A FAIBLE TENEUR. (Study of the Behavior of AX-55 Resin When Used for Recovering Uranium from Solutions Formed by Attacking Low Grade Minerals with Sulfuric Acid.) B. Parly, P. Pottier, and A. Rigaud. Mar. 1959. 16p.

Study of the behavior of AX-55 resin when used for recovering uranium from solutions formed by attacking low grade minerals with sulfuric acid. Uranium is recovered on the anionic resin ACFI AX-55 from solution formed by attacking a Vendean mineral with sulfuric acid. This solution contains 373 mg of uranium acid 15.4 g of SO_4^{2-} per liter. The pH is 1.5. The object of the study is to study the behavior of the AX-55 resin during several absorption and desorption cycles and to see whether this resin can be used industrially. The following conclusions were reached: at the flow rate of 6.6 $m^3/m^2/h$ AX-55 can be used industrially; its principal advantage is

to furnish a concentrated elutrate containing 15.84 g/l of U; it has the disadvantage of having a low capacity (approximately 60 per cent of that of Deacidit "FF"). (auth)

7445 HW-62199

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DISSOLUTION OF STAINLESS STEEL CLAD POWER REACTOR FUELS WITH NITRIC ACID AND HYDROFLUORIC ACID. C. R. Cooley. Oct. 12, 1959. 18p. Contract AT(45-1)-1350. OTS.

The application of the Niflex Process for the dissolution of stainless steel clad fuel elements was studied on a pilot plant scale. A summary of pilot plant data and supporting laboratory information is presented. It was concluded that the process is reasonably successful in laboratory and pilot unit tests; however, more suitable construction materials are needed, and the reaction mechanisms must be studied further for optimization purposes. (J.R.D.)

7446 IDO-14482

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

RAPID TWO-CYCLE EXTRACTION METHOD FOR NEPTUNIUM. INITIAL SEPARATION AS NEPTUNIUM(VI) WITH METHYL ISOBUTYL KETONE. William J. Maeck, Glenn L. Booman, Maxine C. Elliott, and James E. Rein. Sept. 10, 1959. 12p. Contract AT(10-1)-205. OTS.

A method is described for the separation and determination of neptunium in uranium–fission product mixtures. A two-cycle extraction system is used. Neptunium is oxidized to +6 with permanganate and quantitatively extracted as a nitrate complex into methyl isobutyl ketone from an acid deficient aluminum nitrate salting solution containing tetrapropyl ammonium nitrate. Neptunium is stripped from the ketone phase and simultaneously reduced to +4 by contact with ferrous chloride-hydroxylamine solution, then quantitatively extracted into thenoyltrifluoroacetone-xylene. The extraction of uranium and plutonium is less than 0.1% and 0.01%, respectively. Ruthenium and zirconium, the only 80-day cooled fission products which follow the neptunium, are decontaminated to greater than 1×10^4. (auth)

7447 IEA/RQ-4

São Paulo, Brazil. Universidade. Instituto de Energia Atomica.

SEPARAÇÃO DE BISMUTO DO CHUMBO COM ACIDO ETILENODIAMINOTETRAACETICO APLICAÇÃO PARA RADIOQUIMICA. (Separation of Bismuth from Lead with (Ethylenediamine)tetraacetic Acid. Application to Radiochemistry). Fausto W. Lima and Alcídio Abrão. Sept. 1958. 11p.

Bismuth can be separated from lead radiochemically by using (ethylenediamine)tetraacetic acid. The separation is successful when both elements are in trace concentration, when one is in trace concentrations and other in macroconcentrations, and when both are in macroconcentrations. A single separation gives more than 90% of both elements. The process involves simple manipulations and can be done in less than fifteen minutes, which is of importance in the separation of short-lived isotopes. (tr-auth)

7448 NAA-SR-4660

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ELECTROREFINING OF IRRADIATED THORIUM–URANIUM ALLOY. W. N. Hansen, W. L. Long, and E. W. Murbach. Jan. 15, 1960. 18p. Contract AT-11-1-GEN-8. OTS.

An investigation of the electrorefining of irradiated thorium–uranium alloy was carried out. The alloy is dissolved anodically into a fused salt bath of NaCl–KCl eutectic and deposited in a molten zinc cathode. Experiments with irradiated material resulted in the separation of 80 to 90% of the total fission product activity. The product is an alloy of thorium, uranium, and zinc. The zinc can be removed by vacuum distillation. (auth)

7449 ORNL-2821

Oak Ridge National Lab., Tenn.

PROCESS FOR DISSOLUTION OF BORAX IV REACTOR FUEL: LABORATORY DEVELOPMENT. L. M. Ferris. Feb. 1, 1960. 21p. Contract W-7405-eng-26. OTS.

Flowsheets are presented for the dissolution of Borax IV reactor fuel (6.35% $UO_{2.3}$–ThO_2 pellets encased in 1% nickel–aluminum alloy and bonded with lead). In the preferred method the aluminum is dissolved first in boiling 2 M NaOH–1.78 M $NaNO_3$, with a uranium loss of ~0.07%. The lead and nickel are then dissolved in boiling 1.5 M HNO_3, with uranium losses of <0.2%. The oxide core is dissolved in two successive digestions with boiling 13 M HNO_3–0.04 M NaF–0.1 M $Al(NO_3)_3$ to produce a solution 0.6 M in thorium and 0.04 M in uranium. Dissolution of only the aluminum in sodium hydroxide or sodium hydroxide–sodium nitrate solution prior to core dissolution is unattractive since the rate of core dissolution is lowered greatly if lead is present and a product solution containing greater than 0.2 M thorium is unattainable owing to the low solubility of lead nitrate in nitric acid–thorium nitrate solutions. Simultaneous dissolution of aluminum and lead in mercury-catalyzed nitric acid appears costly since a mercury concentration of at least 0.5 M is required to ensure an adequate dissolution rate. The solubility of lead nitrate in nitric acid and nitric acid–thorium nitrate solutions was determined. (auth)

7450 ORNL-2857

Oak Ridge National Lab., Tenn.

SOLUBILITY OF ZIRCONIUM DIBUTYL PHOSPHATE IN SOLVENT EXTRACTION SOLUTIONS. W. Davis, Jr. and H. H. Carmichael. Jan. 20, 1960. 13p. Contract W-7405-eng-26. OTS.

The solubility of zirconium dibutyl phosphate in aqueous uranyl nitrate and nitric acid solutions was found to vary from 0.35 to 159 mg of zirconium per liter, increasing with increasing uranium concentration. The solubility in 1.126 M TBP in Amsco 125-82 equilibrated with uranyl nitrate–nitric acid aqueous solutions was found to vary from 0.33 to 3.55 g of zirconium per liter. Particularly in the extractant solutions, the solubility of zirconium as zirconium dibutyl phosphate is well above the zirconium content of extensively burned natural uranium fuels under Purex process conditions. The zirconium dibutyl phosphate studied was prepared by direct synthesis in aqueous solution and found to have a variable composition. Precipitation from 2 M HNO_3 at 40°C yielded a product which had the approximate composition $Zr(OH)(NO_3)(DBP)_2$. (auth)

7451 ORNL-2863

Oak Ridge National Lab., Tenn.

PURIFICATION OF PROMETHIUM BY LIQUID–LIQUID EXTRACTION. Boyd Weaver and F. A. Kappelmann. Feb. 12, 1960. 24p. Contract W-7405-eng-26. OTS.

A process was developed for separating promethium from mixed fission product rare earths by continuous multistage countercurrent extraction with 100% tri-n-butylphosphate from nitric acid of 12 N or higher concentration. Distribution coefficients at 12 N acidity for neodymium, promethium, and samarium are 0.43, 0.82, and 1.55, respectively. Single-stage separation factors of 1.9 between successive elements can be maintained throughout

the system to give separations dependent only on the number of stages. Extracted values can be recovered from the organic solution by stripping with a smaller volume of dilute nitric acid. A flowsheet for purification of promethium includes one cycle for separation of promethium from neodymium and lighter elements and a second cycle for removal of samarium and heavier elements. Each cycle consists of a series of countercurrent partitioning stages, followed by stripping stages and an evaporator. With 20 stages in the first cycle and 34 stages in the second, a 90% yield of promethium with a purity of 83% can be obtained from a typical mixture of fission product rare earths, assuming essentially perfect mechanical efficiency. An increase to 34 stages in the first cycle would permit a 93% yield of 99% promethium. (auth)

7452 Y-1282

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn. RECOVERY OF URANIUM FROM URANIUM–ZIRCONIUM FUEL SCRAP. T. P. Sprague. Jan. 20, 1958. 31p. Contract W-7405-eng-26. OTS.

Procedures were modified and test runs made for the dissolution of zirconium–uranium alloy scrap and the separation of the uranium from the zirconium by dibutyl carbitol extraction. Uranium containing less than 40 ppm Zr/U_3O_8 can be consistently obtained at increased uranium throughputs. (auth)

7453 CEA-tr-R-768

MÉTHODE CHROMATOGRAPHIQUE DE SÉPARATION DES MÉTAUX PAR FORMATION DES COMPLEXES D'ADSORPTION. (Chromatographic Method for the Separation of Metals by the Formation of Adsorption Complexes). A. M. Gurvich (Gourvich) and T. B. Gapon. Translated into French by B. De Trezvinsky from Zavodskaya Lab. 23, 1037–42(1957). 16p.

A chromatographic technique is described which involves adsorption of cation complexes. A complexant such as dimethylglyoxime, α-nitroso-β-naphthol, or o-oxyquinoline which is strongly adsorbed by activated carbon is used to complex cations as solution flows through the activated carbon column. The cation is then eluted leaving the complexant on the carbon. (T.R.H.)

7454 CEA-tr-X-183

SÉPARATION DU TELLURE(IV) D'AVEC LE TELLURE(VI) PAR LA MÉTHODE D'EXTRACTION PAR SOLVANT. UTILISATION D'UNE SOLUTION À 20% DE PHOSPHATE DE TRIBUTYLE DANS LE KÉROSÈNE (20% TBP–KÉROSÈNE). (Separation of Tellurium(IV) from Tellurium(VI) by the Method of Solvent Extraction. Utilization of a Solution of 20% Tributyl Phosphate in Kerosene (20% TBP–Kerosene). Inanida Mariko. Translated into French by S. S. Minn from Nippon Kagaku Zasshi 79, 696-8(1958). 10p.

It was found that Te^{4+} in 4 to 10 N HCl passes completely into a 20% TBP–kerosene layer leaving Te^{6+} in the aqueous phase. (T.R.H.)

7455

ISOLATION OF THE RARE EARTH ELEMENTS. A CHLORINATION-VOLATILIZATION PROCEDURE. J. Bernard Zimmerman and John C. Ingles (Dept. of Mines and Technical Surveys, Ottawa). Anal. Chem. 32, 241-6 (1960) Feb.

A total chlorination treatment of radioactive ores and concentrates, with simultaneous volatilization at 900°C, eliminates most of the nonrare earth elements, including thorium and scandium. A subsequent ammonia precipitation removes the alkalies and alkaline earths and isolates the rare earths, including yttrium, in a pure concentrate suitable for weighing, spectrographic examination, or colorimetric determination. With materials consisting primarily of uranium and thorium compounds, preliminary extraction from nitric acid medium with a carbon tetrachloride solution of tributyl phosphate eliminates the bulk of these elements. This permits use of a larger sample and thus extends the range of the method. Over-all recoveries of the rare earth elements are 90% or better. (auth)

7456

PHOTOMETER FOR CONTINUOUS DETERMINATION OF URANIUM IN RADIOACTIVE PROCESS STREAMS. F. A. Scott and R. D. Dierks (General Electric Co., Richland, Wash.). Anal. Chem. 32, 268-72(1960) Feb.

A modified single-beam filter photometer for continuous determination of uranium in radioactive process streams is described. Because of a unique standardizing system, it is very stable, having a short-term variation of less than 1% and a calibration stability of 3%. The instrument has a remotely located sensing unit with the ruggedness and simplicity required for production plant applications. The performance of the instrument for monitoring nonradioactive process streams under plant conditions is given. (auth)

7457

THE EXTRACTION OF THORIUM. J. H. Buddery (Atomic Energy Research Establishment, Harwell, Berks, Eng.); W. D. Jamrack (United Kingdom Atomic Energy Authority, Springfields, Lancs, Eng.); and R. A. Wells (National Chemical Lab., Teddington, Middx., Eng.). Chem. & Ind. (London) No. 8, 235–44(1959) Feb. 21.

A review is presented on processes for extraction from monazite which involve only thorium. The methods of ore breakdown, phosphate and rare earth removal, intermediate and final purification, and conversion to pure thoria are described. The electrolytic and calcium reductions of the thoria to metal powder are discussed. (C.J.G.)

7458

EXTRACTION AND SPECTROPHOTOMETRIC DETERMINATION OF URANIUM WITH THENOYLTRIFLUOROACETONE. Shripad M. Khopkar and Anil K. De (Jadavpur Univ., Calcutta). Chem. & Ind. (London) No. 9, 291(1959) Feb. 28.

The extraction of uranium by a thenoyltrifluoroacetone-benzene solution and simultaneous spectrophotometric determination in the yellow benzene layer are reported. Beer's law is obeyed at 430 mμ in the range 5 to 60 γ of uranium. At pH > 3.0 the optical density is almost constant where about 100% extraction occurs. (C.J.G.)

7459

URANIUM ABSORPTION ON ACTIVATED PHENOLIC GROUPS IN ION-EXCHANGE RESIN SYSTEMS. M. J. Holdoway, E. S. Lane, and J. L. Willians (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Chem. & Ind. (London) No. 15, 483(1959) Apr. 11.

It is reported that activated phenolic groups can participate in uranium absorption to a considerable extent at low pH values in ion-exchange resin systems. The resins were condensed to hard rigid gels and processed without allowing them to dry. A resin prepared from p-cresol sulfonic acid, resorcinol, and formaldehyde was found to have the following exchange capacities: Na^+/H^+, 1.25; Ba^{2+}/H^+, 1.30; and UO_2^{2+}/H^+, 1.9. With some sulfonated resins, the estimated uranium absorbed by the phenolic groups amounted to 50% of the total uranium capacity. (C.J.G.)

7460

HOW AEC PLANS TO PROCESS POWER REACTOR

FUELS. C. E. Stevenson (Phillips Petroleum Co., Idaho Falls, Idaho). Nucleonics 18, No. 2, 72-3(1960) Feb.

The processing of spent fuels from research, test, and power reactors is assigned to existing AEC facilities until industry is able to provide the service. The assignments were made to Hanford, Idaho, Oak Ridge, and Savannah River according to the capabilities of each in processing specific fuel types. An outline is presented of fuel types and processes for each facility. (B.O.G.)

7461

AN IMPROVED METHOD OF RECOVERING URANIUM FROM SOLUTION. (to Potasse and Engrais Chimiques). British Patent 822,431. Oct. 28, 1959.

A simple, economical method of recovering U from ores is described. Uranyl solution from the dissolution step is mixed with HCOOH and NH_4F and heated to 90°C, then SO_2 precipitates $UF_4 \cdot NH_4F$. This fluoride can then be reduced by Ca or Mg to metal. Alternatively the double fluoride can be separated, dried, and heated to 250°C to produce UF_4 which is then reduced to U metal by Ca or Mg. (T.R.H.)

7462

NEPTUNIUM SOLVENT EXTRACTION PROCESS. L. R. Dawson and P. R. Fields (to U. S. Atomic Energy Commission). U. S. Patent 2,907,628. Oct. 6, 1959.

The separation of neptunium from an aqueous solution by solvent extraction and the extraction of neptunium from the solvent solution are described. Neptunium is separated from an aqueous solution containing tetravalent or hexavalent neptunium nitrate, nitric acid, and a nitrate salting out agent, such as sodium nitrate, by contacting the solution with an organic solvent such as diethyl ether. Subsequently, the neptunium nitrate is extracted from the organic solvent extract phase with water.

7463

METHOD OF REDUCING PLUTONIUM WITH FERROUS IONS. J. L. Dreher, D. E. Koshland, S. G. Thompson, and J. E. Willard (to U. S. Atomic Energy Commission). U. S. Patent 2,907,631. Oct. 6, 1959.

A process is presented for separating hexavalent plutonium from fission product values. To a nitric acid solution containing the values, ferrous ions are added and the solution is heated and held at elevated temperature to convert the plutonium to the tetravalent state via the trivalent state, and the plutonium is then selectively precipitated on a $BiPO_4$ or LaF_3 carrier. The tetravalent plutonium formed is optionally complexed with fluoride, oxalate, or phosphate anion prior to carrier precipitation.

7464

STRIPPING PROCESS FOR PLUTONIUM. M. Kolodney (to U. S. Atomic Energy Commission). U. S. Patent 2,907,700. Oct. 6, 1959.

A method for removing silver, nickel, cadmium, zinc, and indium coatings from plutonium objects while simultaneously rendering the plutonium object passive is described. The coated plutonium object is immersed as the anode in an electrolyte in which the plutonium is passive and the coating metal is not passive, using as a cathode a metal which does not dissolve rapidly in the electrolyte, and passing an electrical current through the electrolyte until the coating metal is removed from the plutonium body.

7465

SEPARATION OF URANIUM, PLUTONIUM AND FISSION PRODUCTS. C. M. Nicholls, I. Wells, and R. Spence (to U. S. Atomic Energy Commission). U. S. Patent 2,908,547. Oct. 13, 1959.

The separation of uranium and plutonium from neutron-irradiated uranium is described. The neutron-irradiated uranium is dissolved in nitric acid to provide an aqueous solution 3N in nitric acid. The fission products of the solution are extruded by treating the solution with dibutyl carbitol substantially 1.8N in nitric acid. The organic solvent phase is separated and neutralized with ammonium hydroxide and the plutonium reduced with hydroxylamine base to the trivalent state. Treatment of the mixture with saturated ammonium nitrate extracts the reduced plutonium and leaves the uranium in the organic solvent.

7466

PROCESS FOR DECONTAMINATING THORIUM AND URANIUM WITH RESPECT TO RUTHENIUM. A. A. Meservey and R. H. Rainey (to U. S. Atomic Energy Commission). U. S. Patent 2,909,406. Oct. 20, 1959.

The control of ruthenium extraction in solvent-extraction processing of neutron-irradiated thorium is presented. Ruthenium is rendered organic-insoluble by the provision of sulfite or bisulfite ions in the aqueous feed solution. As a result the ruthenium remains in the aqueous phase along with other fission product and protactinium values, thorium and uranium values being extracted into the organic phase. This process is particularly applicable to the use of a nitrate-ion-deficient aqueous feed solution and to the use of tributyl phosphate as the organic extractant.

7467

SEPARATION OF POLONIUM, PROTACTINIUM OR MIXTURES THEREOF IN AQUEOUS SOLUTION FROM BISMUTH, LEAD, ZIRCONIUM AND/OR COLUMBIUM VALUES. Q. Van Winkle and K. A. Kraus (to U. S. Atomic Energy Commission). U. S. Patent 2,910,345. Oct. 27, 1959.

A process is presented for separating polonium, protactinium, or mixtures thereof in aqueous solution from bismuth, zirconium, lead, and niobium values contained in the solution. The method comprises providing hydrochloric acid in the solution in a concentration of at least 5N, contacting the aqueous solution with a substantially water-immiscible organic solvent such as diisopropyl ketone, and separating the aqueous phase containing the bismuth, zirconium, lead, and niobium from the organic extract phase containing the polonium, protactinium, or mixture thereof.

7468

SOLVENT FOR EXTRACTING ACTINIDE SALTS. L. Kaplan (to U. S. Atomic Energy Commission). U. S. Patent 2,910,442. Oct. 27, 1959.

A mixture of hexone and 2-hexylpyridine can be used for the selective extraction of actinide values.

7469

METHOD OF RECOVERING PLUTONIUM VALUES FROM AQUEOUS SOLUTIONS BY CARRIER PRECIPITATION. R. A. James and S. G. Thompson (to U. S. Atomic Energy Commission). U. S. Patent 2,911,282. Nov. 3, 1959.

A process is presented for pretreating aqueous nitric acid–plutonium solutions containing a small quantity of hydrazine that has formed as a decomposition product during the dissolution of neutron-bombarded uranium in nitric acid and that impairs the precipitation of plutonium on bismuth phosphate. The solution is digested with alkali metal dichromate or potassium permanganate at between 75 and 100°C; sulfuric acid at approximately 75°C and sodium nitrate, oxalic acid plus manganous nitrate, or hydroxylamine are added to the solution to secure the plutonium in the tetravalent state and make it suitable for precipitation on $BiPO_4$.

7470

PROCESS FOR RECOVERY OF URANIUM VALUES FROM IMPURE SOLUTIONS THEREOF. S. B. Kilner (to U. S. Atomic Energy Commission). U. S. Patent 2,911,283. Nov. 3, 1959.

A process is presented for the recovery of uranium values from impure solutions which are obtained, for example, by washing residual uranium salt or uranium metal deposits from stainless steel surfaces using an aqueous or certain acidic aqueous solutions. The solutions include uranyl and oxidized iron, chromium, nickel, and copper ions and may contain manganese, zinc, and silver ions. In accordance with one procedure, the uranyl ions are reduced to the uranous state, and the impurity ions are complexed with cyanide under acidic conditions. The solution is then treated with ammonium hydroxide or alkali metal hydroxide to precipitate uranous hydroxide away from the complexed impurity ions in the solution. Alternatively, an excess of alkali metal cyanide is added to the reduced solution until the solution becomes sufficiently alkaline for the uranous hydroxide to precipitate. An essential feature in operating the process is in maintaining the pH of the solution sufficiently acid during the complexing operation to prevent the precipitation of the impurity metal hydroxides.

7471

PROCESSES FOR SEPARATING AND RECOVERING CONSTITUENTS OF NEUTRON IRRADIATED URANIUM. R. E. Connick, J. W. Gofman, and G. C. Pimentel (to U. S. Atomic Energy Commission). U. S. Patent 2,912,302. Nov. 10, 1959.

Processes are described for preparing plutonium, particularly processes of separating plutonium from uranium and fission products in neutron-irradiated uranium-containing matter. Specifically, plutonium solutions containing uranium, fission products and other impurities are contacted with reducing agents such as sulfur dioxide, uranous ion, hydroxyl ammonium chloride, hydrogen peroxide, and ferrous ion whereby the plutonium is reduced to its fluoride-insoluble state. The reduced plutonium is then carried out of solution by precipitating niobic oxide therein. Uranium and certain fission products remain behind in the solution. Certain other fission products precipitate along with the plutonium. Subsequently, the plutonium and fission product precipitates are redissolved, and the solution is oxidized with oxidizing agents such as chlorine, peroxydisulfate ion in the presence of silver ion, permanganate ion, dichromate ion, ceric ion, and a bromate ion, whereby plutonium is oxidized to the fluoride-soluble state. The oxidized solution is once again treated with niobic oxide, thus precipitating the contaminant fission products along with the niobic oxide while the oxidized plutonium remains in solution. Plutonium is then recovered from the decontaminated solution.

7472

DISSOLUTION OF LANTHANUM FLUORIDE PRECIPITATES. B. A. Fries (to U. S. Atomic Energy Commission). U. S. Patent 2,912,303. Nov. 10, 1959.

A plutonium separatory ore concentration procedure involving the use of a fluoride type of carrier is presented. An improvement is given in the derivation step in the process for plutonium recovery by carrier precipitation of plutonium values from solution with a lanthanum fluoride carrier precipitate and subsequent derivation from the resulting plutonium bearing carrier precipitate of an aqueous acidic plutonium-containing solution. The carrier precipitate is contacted with a concentrated aqueous solution of potassium carbonate to effect dissolution therein of at least a part of the precipitate, including the plutonium values. Any remaining precipitate is separated from the resulting solution and dissolves in an aqueous solution containing at least 20% by weight of potassium carbonate. The reacting solutions are combined, and an alkali metal hydroxide added to a concentration of at least 2N to precipitate lanthanum hydroxide concomitantly carrying plutonium values.

7473

ELUTION OF URANIUM VALUES FROM ION EXCHANGE RESINS. R. H. Kennedy (to U. S. Atomic Energy Commission). U. S. Patent 2,914,378. Nov. 24, 1959.

A process is described for eluting complex uranium ions absorbed on ion exchange resins. The resin is subjected to the action of an aqueous eluting solution containing sulfuric acid and an alkali metal, ammonium, or magnesium chloride or nitrate, the elution being carried out until the desired amount of the uranium is removed from the resin.

7474

REMOVAL OF CERTAIN FISSION PRODUCT METALS FROM LIQUID BISMUTH COMPOSITIONS. O. E. Dwyer, H. E. Howe, and E. R. Avrutik (to U. S. Atomic Energy Commission). U. S. Patent 2,914,399. Nov. 24, 1959.

A method is described for purifying a solution of uranium in liquid bismuth containing at least one metal from the group consisting of selenium, tellurium, palladium, ruthenium, rhodium, niobium, and zirconium. The solution is contacted with zinc in an inert atmosphere to form a homogeneous melt, a solid zinc phase is formed, and the zinc phase containing the metal is separated from the melt.

7475

PLUTONIUM CLEANING PROCESS. M. Kolodney (to U. S. Atomic Energy Commission). U. S. Patent 2,915,387. Dec. 1, 1959.

A method is described for rapidly removing iron, nickel, and zinc coatings from plutonium objects while simultaneously rendering the plutonium object passive. The method consists of immersing the coated plutonium object in an aqueous acid solution containing a substantial concentration of nitrate ions, such as fuming nitric acid.

7476

CONTINUOUS CHELATION-EXTRACTION PROCESS FOR THE SEPARATION AND PURIFICATION OF METALS. J. R. Thomas, T. E. Hicks, B. Rubin, and H. W. Crandall (to U. S. Atomic Energy Commission). U. S. Patent 2,916,349. Dec. 8, 1959.

A continuous process is presented for separating metal values and groups of metal values from each other. A complex mixture, e.g., neutron-irradiated uranium, can be resolved into component parts. In the present process the values are dissolved in an acidic solution and adjusted to the proper oxidation state. Thenceforth the solution is contacted with an extractant phase comprising a fluorinated β-diketone in an organic solvent under certain pH conditions whereupon plutonium and zirconium are extracted. Plutonium is extracted from the foregoing extract with reducing aqueous solutions or under specified acidic conditions and can be recovered from the aqueous solution. Zirconium is then removed with an oxalic acid aqueous phase. The uranium is recovered from the residual original solution using hexone and hexone-diketone extractants leaving residual fission products in the original solution. The uranium is extracted from the hexone solution with dilute nitric acid. Improved separations and purifications are achieved using recycled scrub solutions and the "self-salting" effect of uranyl ions.

7477
URANOUS IODATE AS A CARRIER FOR PLUTONIUM. D. R. Miller, G. T. Seaborg, and S. G. Thompson (to U. S. Atomic Energy Commission). U. S. Patent 2,917,358. Dec. 15, 1959.

A process is described for precipitating plutonium on a uranous iodate carrier from an aqueous acid solution containing the plutonium in a valence state not greater than +4. A plutonium solution more concentrated than the original solution can then be obtained by oxidizing the uranium to the hexavalent state and dissolving the precipitate, after separating the latter from the original solution, by means of warm nitric acid.

7478
SEPARATION OF FISSION PRODUCT VALUES FROM THE HEXAVALENT PLUTONIUM BY CARRIER PRECIPITATION. T. H. Davies (to U. S. Atomic Energy Commission). U. S. Patent 2,917,359. Dec. 15, 1959.

An improved precipitation of fission products on bismuth phosphate from an aqueous mineral acid solution also containing hexavalent plutonium by incorporating, prior to bismuth phosphate precipitation, from 0.05 to 2.5 grams/liter of zirconium phosphate, niobium oxide, and/or lanthanum fluoride is described. The plutonium remains in solution.

7479
METHOD OF RECOVERING TRANSURANIC ELEMENTS OF AN ATOMIC NUMBER BELOW 95. G. T. Seaborg and R. A. James (to U. S. Atomic Energy Commission). U. S. Patent 2,917,361. Dec. 15, 1959.

The concentration of neptunium or plutonium by two carrier precipitation steps with identical carriers but using (after dissolution of the first carrier in nitric acid) a reduced quantity of carrier for the second precipitation is discussed. Carriers suitable are uranium(IV) hypophosphate, uranium(IV) pyrophosphate, uranium(IV) oxalate, thorium oxalate, thorium citrate, thorium tartrate, thorium sulfide, and uranium(IV) sulfide.

7480
SEPARATION OF PLUTONIUM FROM URANIUM. H. M. Feder and R. L. Nuttall (to U. S. Atomic Energy Commission). U. S. Patent 2,917,382. Dec. 15, 1959.

A process is described for extracting plutonium from powdered neutron-irradiated uranium metal by contacting the latter, while maintaining it in the solid form, with molten magnesium which takes up the plutonium and separating the molten magnesium from the solid uranium.

7481
EXTRACTION OF PLUTONIUM VALUES FROM ORGANIC SOLUTIONS. G. T. Seaborg (to U. S. Atomic Energy Commission). U. S. Patent 2,918,349. Dec. 22, 1959.

A process is described for back-extracting plutonium, present in an organic solvent in at least the tetravalent state, with nitric acid.

7482
URANIUM DECONTAMINATION. J. S. Buckingham and J. L. Carroll (to U. S. Atomic Energy Commission). U. S. Patent 2,918,350. Dec. 22, 1959.

A process is described for reducing the extractability of ruthenium, zirconium, and niobium values into hexone contained in an aqueous nitric acid uranium-containing solution. The solution is made acid-deficient, heated to between 55 and 70°C, and at that temperature a water-soluble inorganic thiosulfate is added. By this, a precipitate is formed which carries the bulk of the ruthenium, and the remainder of the ruthenium as well as the zirconium and niobium are converted to a hexone-nonextractable form. The ruthenium-containing precipitate can either be removed from the solution or it can be dissolved as a hexone-non-extractable compound by the addition of sodium dichromate prior to hexone extraction.

7483
DECONTAMINATION OF NEUTRON-IRRADIATED REACTOR FUEL. A. G. Buyers, F. D. Rosen, and E. E. Motta (to U. S. Atomic Energy Commission). U. S. Patent 2,918,366. Dec. 22, 1959.

A pyrometallurgical method of decontaminating neutron-irradiated reactor fuel is presented. In accordance with the invention, neutron-irradiated reactor fuel may be decontaminated by countercurrently contacting the fuel with a bed of alkali and alkaline fluorides under an inert gas atmosphere and inductively melting the fuel and tracking the resulting descending molten fuel with induction heating as it passes through the bed. By this method, a large, continually fresh surface of salt is exposed to the descending molten fuel which enhances the efficiency of the scrubbing operation.

7484
PROCESS OF RECOVERING URANIUM. S. B. Kilner (to U. S. Atomic Energy Commission). U. S. Patent 2,919,175. Dec. 29, 1959.

A method is presented for separating and recovering uranium from a complex mixture of impurities. The uranium is dissolved to produce an aqueous acidic solution including various impurities. In accordance with one method, with the uranium in the uranyl state, hydrogen cyanide is introduced into the solution to complex the impurities. Subsequently, ammonia is added to the solution to precipitate the uranium as ammonium diuranate away from the impurities in the solution. Alternatively, the uranium is precipitated by adding an alkaline metal hydroxide. In accordance with the second method, the uranium is reduced to the uranous state in the solution. The reduced solution is then treated with solid alkali metal cyanide sufficient to render the solution about 0.1 to 1.0 N in cyanide ions whereat cyanide complex ions of the metal impurities are produced and the uranium is simultaneously precipitated as uranous hydroxide. Alternatively, hydrogen cyanide may be added to the reduced solution and the uranium precipitated subsequently by adding ammonium hydroxide or an alkali metal hydroxide. Other refinements of the method are also disclosed.

ENGINEERING AND EQUIPMENT

General and Miscellaneous

7485 NAA-SR-4388
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
A LINEAR INDUCTION PUMP FOR LIQUID METALS. R. S. Baker. Jan. 15, 1960. 25p. Contract AT-11-1-GEN-8. OTS.

A linear induction pump of a special design was used to circulate molten sodium through a mockup of an experimental "overflow" type of sodium-cooled reactor. The distinctive features of this pump are that no seals or moving parts are required; no piping is required to carry sodium to the pump or away from it because the pump is mounted directly on the reactor vessel, with the windings outside of the vessel and the magnetic flux return path inside the vessel. The pump develops 342 gpm at 6.2 psi when pumping sodium at 600°F with an efficiency of 4.7%. (auth)

7486 NYO-2639
Textile Research Inst., Princeton, N. J.
STUDY OF THE INDUSTRIAL POTENTIAL OF RADIOISOTOPIC METHODS IN THE TEXTILE INDUSTRY. Quarterly Progress Report for the Period October 1, 1959–December 31, 1959. Ludwig Rebenfeld and Howard J. White, Jr. Feb. 5, 1960. 27p. Contract AT(30-1)-2365. OTS.

The potential or actual uses of radioisotopes in the textile industry are reported. Radiation gaging is discussed relative to current uses and proposed uses which need development or evaluation. The uses of radiation for grafting, polymer impregnation, and static elimination are discussed. (C.J.G.)

7487 NYO-8704
Westinghouse Electric Corp. Research Labs., Pittsburgh
USE OF TEFLON IN ULTRAHIGH VACUUM SYSTEMS. Research Memo 403FF312-M1. W. J. Lange and H. Riemersma. Jan. 5, 1959. 7p. Contract AT(30-1)-2176. OTS.

Teflon was found to have the first bakeout around 350°C which resulted in a deformation of 5 to 10%. A vacuum valve employing Teflon as a nose against stainless steel yielded a closed conductance of $< 10^{-14}$ l/sec at closing torques of less than one fifth that required to close an identical valve employing a copper nose. (C.J.G.)

7488 SCTM-409-59-25
Sandia Corp., Albuquerque, N. Mex.
SCREW TIGHTNESS. George W. Chandler. Dec. 28, 1959. 6p. OTS.

Methods of measuring screw tightness and the range of tightness obtained by use of a tightening torque are discussed. A method for establishing torque values is discussed, and ways of making the best use of a torque callout are suggested. (auth)

7489 UCRL-5631-T
California. Univ., Livermore. Lawrence Radiation Lab.
THE DESIGN OF LARGE CRYOGENIC MAGNET COILS. PAPER NO. 2. Clyde E. Taylor and Richard F. Post. [Oct. 30, 1959]. 15p. Contract [W-7405-eng-48]. OTS.

Preliminary design and experimental work aimed toward fabrication of large magnet coils with encapsulated sodium conductors is outlined. Aspects of cooling cycles are discussed along with heat transfer, thermal stability, and the mechanical reinforcement of such coils. (J.R.D.)

7490 WAPD-TM-182
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
DEFLECTIONS AND LOAD DISTRIBUTIONS IN LINEAR ELASTIC STRUCTURES—CTAC AND MODE CODES. Carl M. Friedrich. Jan. 1960. 46p. Contract AT-11-1-GEN-14. OTS.

Since the stress analysis of a complicated statically indeterminate structure involves the handling of many simultaneous equations, the S0207 code for the IBM-650 was developed at Bettis to solve this problem by the use of matrix transformations. The code has two parts, each with a title: (a) the CTAC code gives stresses, deflections, and reactions; and (b) the MODE code calculates natural frequencies and modes of vibration. As an aid to users of the code, a review is given of the elasticity and matrix transformation theory utilized in this code. (auth)

7491
NEW CONTAINER FOR HIGHLY RADIOACTIVE MATERIALS. V. Sinitsyn, N. Leshchinskiĭ, and A. Gusev. Atomnaya Energ. 7, 399-400(1959) Oct. (In Russian)

Descriptions are given of a new container designed for transporting and handling highly radioactive sources. The container holds up to four standard cobalt sources of 700 g eqv. Ra, which can be transferred directly from the container into the loading channels of an installation. The radioactivity from the container at 0.5 m does not exceed 2.5 μr/sec. The weight of the container is 1 ton. (R.V.J.)

7492
"BREEDER ACTIVATION" AS A NEW AID IN PROCESS TECHNOLOGY. Heinz Engelbach and Oswald Riedel (Badische Anilin-& Soda-Fabrik AG., Ludwigshafen am Rhein, Ger.). Chem. Ing. Tech. 31, 318-23(1959) May. (In German)

The new tagging process is discussed using the example of velocity measurement on heat carrier particles in a "travelling" layer plant. The otherwise normal method of producing the tagged particles with the aid of radionuclides produced beforehand, is here frequently inapplicable. As a result of their mixed composition, however, normal particles taken from the stock can be "breeder activated" by the neutrons from a nuclear reactor. These γ-emitting test particles, the number of which may reach several hundred, make numerous measurements possible under operating conditions in a short time. (auth)

7493
DEVELOPMENT OF CENTRIFUGAL PUMPS FOR OPERATION WITH LIQUID METALS AND MOLTEN SALTS AT 1100–1500°F. A. G. Grindell, W. F. Boudreau, and H. W. Savage (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 7, 83-91(1960) Jan.

Sump-type centrifugal pumps ranging in capacity from 2 to 1500 gpm were developed for circulating liquid metals and molten salts at temperatures up to 1500°F in metallurgical, heat transfer, and reactor experiments. Each of these pumps uses a nearly conventional bearing assembly to support a vertical shaft and an impeller suspended in a tank containing the high-temperature liquid and an inert blanketing gas. Drive motors and lubrication equipment are external to the pump proper. Seven different models of the sump-type pumps were manufactured and about 400,000 hr of operation were accumulated in the temperature range 1100 to 1500°F. Problems resolved in the development of these pumps are discussed. Limitations on the use of this type of pump for reactor and nonreactor applications are noted. (auth)

7494
TRANSISTORIZED VOICE AMPLIFIER FOR USE WITH RESPIRATORY MASKS. J. R. Gaskill and O. L. Meadors (Univ. of California, Livermore). Nucleonics 18, No. 2, 82(1960) Feb.

A transistorized voice-amplifier system was developed for use in various types of respirators worn while handling radioisotopes or other toxic materials. A schematic diagram and a description of the system are included. (B.O.G.)

7495
SLIDE RULE SIMPLIFIES XENON COMPUTATIONS. David E. Dickey and John E. McEwen, Jr. (Westinghouse Electric Corp., Pittsburgh). Nucleonics 18, No. 2, 88; 90; 92-3; 95(1960) Feb.

Methods for the calculation of reactivity due to Xe^{135} build-up after reactor shutdown are presented. Differential equations and curves used in the calculations are illustrated along with a slide rule designed for these computations. Procedures are outlined for the use of the slide rule

in calculating the reactivity values. Its accuracy is 1 to 2%, which compares favorably with other methods. (B.O.G.)

7496

BRITONS OPEN PILOT PLANT TO TRY RADIATION PROCESSES. John Tunstall (McGraw-Hill World News, London). Nucleonics 18, No. 2, 100; 103-4(1960) Feb.

A description is given for an irradiation facility using 150,000 curies of Co^{60} to irradiate packaged products at an estimated $0.017/megarad-lb. The standardized packages are moved into the irradiation cell, shuffle back and forth on both sides of a single slab source, and then move out onto an output rack. The estimated costs and output figures for the plant are included. (B.O.G.)

7497

GRINDER FOR SECTIONING SOLID DIFFUSION SPECIMENS. H. W. Schamp, Jr., D. A. Oakes, and N. M. Reed (Univ. of Maryland, College Park). Rev. Sci. Instr. 30, 1028-31(1959) Nov.

A grinder which can be used for sectioning diffusion specimens in which the average diffusion distance is a very few microns is described. Three fixed steel balls are used to determine the grinding plane of the instrument, and the specimen is held with constant orientation at the center of the triangle formed by the balls. The orientation of the grinding plane with respect to the specimen surface can be changed to make the two parallel by adjusting the lengths of the legs to which the steel balls are attached. These lengths can be adjusted over several centimeters, permitting a large variation in specimen thickness and orientation. A differential screw arrangement on each leg makes it possible to orient the grinding plane and crystal surface to within 5×10^{-6} radian with respect to one another. The shaft on which the specimen remains mounted during the entire grinding procedure can be moved in a line perpendicular to the grinding plane so that the specimen surface protrudes beyond the grinding plane. A solid grinding plate is then used to grind the specimen away until the surface lies in the plane. Since no loose grinding compound is used, the material removed from the specimen can easily be collected for preparing a radioactive slide. It is also possible to assay the radioactivity of the specimen itself. The motion of the shaft, and, consequently, the thickness ground away, is measured directly using an electronic indicator and is checked every 10μ against gauge blocks. It is estimated that sections parallel to within 10^{-5} radian and with the thickness known to the order of a few hundredths of a micron can be removed with the device, the lower limit on the thickness of the slice being about 1 μ. (auth)

7498

LIQUID HELIUM TRAP FOR HIGH PUMPING SPEED AT LOW PRESSURES. Hollis L. Caswell (IBM Corp., Poughkeepsie, N. Y.). Rev. Sci. Instr. 30, 1054-5(1959) Nov.

A description is given of a liquid helium thimble trap which is situated immediately in the evaporation chamber. A pumping speed of 700 to 1000 l/sec is indicated for the trap at pressures in the 10^{-9} mm Hg range. (C.J.G.)

7499

HIGH-PRESSURE AND VACUUM SEALS AT LIQUID HELIUM TEMPERATURES. K. S. Balain and C. J. Bergeron (Louisiana State Univ., Baton Rouge). Rev. Sci. Instr. 30, 1058-9(1959) Nov.

The construction and performance of epoxy resin seals for use in high pressures (up to 2400 psi) and high-vacuum (10^{-7} mm Hg) systems at 1.2 to 300°K are described. (C.J.G.)

7500

ARC-IMAGE FURNACE FOR GROWTH OF SINGLE CRYSTALS. Robert E. De La Rue and Frank A. Halden (Stanford Research Inst., Menlo Park, Calif.). Rev. Sci. Instr. 31, 35-8(1960) Jan.

A carbon arc-image furnace was designed and employed for the growth of single crystals of refractory compounds. The image furnace is a unique facility for this application since it provides a sharply defined hot zone, excellent atmosphere control, and complete freedom from contamination during crystal growth. General operating and performance characteristics of this furnace are described. (auth)

7501

CONVENIENT LABORATORY FURNACE FOR TEMPERATURES UP TO 1700°C IN AIR. John R. Soulen and John L. Margrave (Univ. of Wisconsin, Madison). Rev. Sci. Instr. 31, 68-9(1960) Jan.

Procedures are presented for the construction of a convenient laboratory furnace for temperatures up to 1700°C in air. A hollow tube of silicon carbide insulated with fire brick was used in the construction. After a year of use (and abuse by overheating) there was a 3-in. section in the center over which the temperature was constant to ±3°C at 1480°C. Specifications state that the maximum temperature for the Globar is 1550°C, but it is capable of producing temperatures of up to 1700°C. (B.O.G.)

7502

DISCUSSING ULTRAHIGH VACUUM. J. Schweitzer (Centre d'Etudes Nucleaires, Saclay, France). Vide 14, 165-82 (1959) July-Aug. (In French and English)

The physical basis of ultra-high vacuum and the factors limiting its achievement in large volumes are discussed. The influence of surface phenomena on the limiting factors was examined for the cases of gas influx and evolution. It is noted that the Knudsen equation expressing the conductance of a duct does not take into account the influence of the sticking time of adsorbed particles. (C.J.G.)

7503

EXPERIMENTAL STUDY OF METAL GASKETED JOINTS FOR ULTRA-HIGH VACUUMS. J. P. Boulloud and J. Schweitzer (Centre d'Etudes Nucléaires, Saclay, France). Vide 14, 241-9(1959) July-Aug. (In French and English)

Various types of leak-tight metal joints were studied relative to their application in assemblies containing total vacuums. Their integrity was tested with a Helium leak detector, and leaks of about 2×10^{-12} cm^3 atmos/sec per meter of joint were measured simultaneously with the clamping effort applied at the joint and the deformation of the metal gasket. The integrity to clamping effort ratio curve was not retraced in reverse upon relaxation of the clamping effort, but a "return curve" analogous to a hysteresis cycle explains why certain types of joints retain their integrity at high temperatures. The use of a tracer gas permitted discrimination between external permeation of the joint and gas from occlusions between its mating surfaces. It was found that neither the nature nor the purity or surface condition of the joint had any basic influence on its integrity. Clamping effort values of various joints and for total integrity are given. (auth)

7504

ENCYCLOPEDIC DICTIONARY OF ELECTRONICS AND NUCLEAR ENGINEERING. Robert I. Sarbacher. Englewood Cliffs, N. J., Prentice-Hall, Inc., 1959. 1422p.

Basic definitions of terms in electronic and nuclear engineering are defined with pertinent supplementary

information being included. Terms of elemental electric and magnetic theory and atomic physics are included as well as definitions from broader principles of physics. (C.J.G.)

7505

VOLUME COMPENSATING MEANS FOR PULSATING PUMPS. D. L. W. Weaver and R. S. MacCormack, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,915,016. Dec. 1, 1959.

A double diaphragm, two-liquid pulsating pump for remote control use, having as an improvement an apparatus for maintaining constant the volume of the liquid such as kerosene between the two diaphragms is described. Phase difficulties encountered in the operation of such pumps when the volume of the liquid is altered by changes in temperature are avoided.

7506

METHOD OF INCREASING THE DISPERSIBILITY OF SLURRY PARTICLES. J. P. McBride (to U. S. Atomic Energy Commission). U. S. Patent 2,917,406. Dec. 15, 1959.

A method is described for increasing the dispersibility of metallic oxide particles, particularly thorium oxide, in slurries. Organo-silicon compounds, such as organosilicon halides and silicate esters, are deposited on the surface of the oxide particles. A firing step conducted at temperatures of 600 to 1200°C removes the organic groups leaving a surface coating of silica, which provides the desired increase in particle dispersibility.

Heat Transfer and Fluid Flow

7507 AD-226315

Stanford Univ., Calif.

HEAT TRANSFER AND FLOW FRICTION CHARACTERISTICS OF CROSSED-ROD MATRICES. Technical Report No. 41. A. L. London, J. W. Mitchell, and W. A. Sutherland. July 15, 1959. 53p. Contract Nonr-225(23).

All the previous results of interest to the designer on woven-screen matrices and crossed-rod matrices of a random configuration are summarized. In addition, new design results for the regular in-line and regular staggered crossed-rod matrix configurations are reported. Matrices of the type considered may find application as heat transfer surface geometries for periodic-flow type heat exchangers used for gas turbine regenerators and for some air conditioning applications, and also for nuclear reactor fuel elements, or for electrical resistance heaters. (auth)

7508 AECU-4439

California. Univ., Los Angeles and Ramo-Wooldridge Corp., Los Angeles.

HYDRODYNAMIC ASPECTS OF BOILING HEAT TRANSFER (thesis). Novak Zuber. June 1959. 210p. OTS.

A study concerned with the determination of the limiting hydrodynamic conditions which characterize nucleate and transitional boiling was conducted. The critical heat flux and the minimum heat flux are derived from these hydrodynamic limits. Results of investigations of nucleate boiling are discussed and the theory of bubble growth is extended to include the effect of non-uniform temperature fields. An equation is derived for the product bubble diameter times frequency of bubble emission, and data showing that the diameter of nucleating cavities can be related to the heat flux density and superheat difference are presented. (J.R.D.)

7509 AERE-R-3028

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England and Gt. Brit. National Engineering Lab., East Kilbride, Glasgow, Scotland.

THE MEASUREMENT OF TURBULENT FLOW IN PIPES USING RADIOACTIVE ISOTOPES. THE ISOTOPE DILUTION TECHNIQUE. C. G. Clayton, Anne M. Ball, and E. A. Spencer. Sept. 1959. 28p. BIS.

An experimental investigation which was carried out to determine the ultimate accuracy of the dilution technique using radioactive sodium-24 is described. The measurements were made on a standard 20 in. diameter pipe operating with flow rates of approximately 4 and 20 cusecs (cu. ft per sec). Initial comparisons with absolute measurements based on direct weighing resulted in a deviation of the mean from the absolute value of −2.63 per cent with a standard mean deviation of ±1.5 per cent. (auth)

7510 AGN-TM-364

Aerojet-General Nucleonics, San Ramon, Calif.

ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM—TEMPERATURE DISTRIBUTION IN A UO_2 FUEL PELLET AND SURROUNDING METAL WALL. J. L. Routbort. Oct. 1959. 30p. Contract AT(10-1)-880. OTS.

A general analytical solution for the temperature distribution in a UO_2 fuel pellet and in the metal wall surrounding the pellet is presented. The fuel element is typical of that being developed for the second core of the Gas-Cooled Reactor Experiment I. General derivatives, solutions, sample calculations, and curves are included. (auth)

7511 AEC-tr-3928

RADIANT HEAT TRANSFER IN A FLOWING RADIATING MEDIUM. (Luchistyĭ Teploobmen v Potoke Izluchayushchei Sredy). V. N. Adrianov and S. N. Shorin. Translated from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk No. 5, 46-50 (1958). 11p. OTS.

Aspects of radiant heat transfer from radiating products of combustion through the heated surfaces are considered. The problem is attacked through consideration of the nonuniformity of radiating medium flow for cylindrical and plain canals. Curves are plotted from analytical data and solutions for the cases of both the cylindrical and plain canals are presented. (J.R.D.)

7512

HEAT TRANSFER TO MERCURY FLOWING IN ANNULAR CHANNELS. V. I. Petrovichev. Atomnaya Energ. 7, 366-9(1959) Oct. (In Russian)

Descriptions are given of the two installations used for experimental investigations of mercury heat transfer in turbulent flow at 0.3 to 2.25 m/sec through annular channels at 30 to 50°C. The dimensionless simularity criteria for the heat transfer processes were calculated along the diameter. A formula is recommended for estimating heavy liquid metal heat transfer in turbulent flow in annular channels. (R.V.J.)

7513

LOW-TEMPERATURE HEAT EXCHANGERS. P. M. Schuftan (British Oxygen Engineering Co., Ltd., London). Brit. Chem. Eng. 5, 12-14(1960) Jan.

Characteristics of several types of heat exchangers used in low-temperature gas separation are presented. Required conditions to be met by the condenser reboiler, an essential element in low-temperature gas separation processes, are listed. The economics of heat exchangers as determined by fixed and running costs are related. The effect of efficiency on power consumption is discussed. (B.O.G.)

7514

THE APPLICATION OF REGENERATORS AND HEAT EXCHANGERS. D. E. Ward (British Oxygen Engineering Co., Ltd., London). Brit. Chem. Eng. 5, 15-17(1960) Jan.

The regenerator and reversing heat exchanger are defined as to their function in low-temperature gas processing. A comparison is made of the relative merits of the exchanger and regenerator. The essential heat exchange requirements of the equipment are: (1) the pressure drop must be small to conserve power; (2) the temperature difference must be small to conserve refrigeration and power; (3) the exchanger should be compact; and (4) the capital cost must be low. (B.O.G.)

7515

APPLICATIONS AND DESIGN OF PLATE-FIN HEAT EXCHANGERS. W. H. Denton (Atomic Energy Research Establishment, Harwell, Berks, Eng.) and D. E. Ward (British Oxygen Engineering Ltd., Edmonton, Eng.). Brit. Chem. Eng. 5, 18-26(1960) Jan.

The advantage of using a plate-fin heat exchanger in low-temperature gas separation is discussed in connection with its high heat transfer and gas purification characteristics. Equations are derived for the calculation of the coefficients and dimensions of the heat exchanger block. An illustration of the seriousness of flow maldistribution in a heat exchanger is given. (B.O.G.)

7516

SECONDARY SURFACE HEAT EXCHANGERS. A. G. Lenfestey (Marston Excelsior Ltd., Wolverhampton, Eng.). Brit. Chem. Eng. 5, 27-32(1960) Jan.

The use of secondary surface plate-and-corrugation heat exchangers is well established for aircraft applications because their compact form and low weight are ideally suited. The design and construction of a heat exchanger of this type are presented in connection with low-temperance heat transfer. Illustrations of the design and possible arrangements of the surfaces are included. Heat transfer characteristics and a range of applications to low-temperature processes are asserted in the discussion. (B.O.G.)

7517

A SIMPLIFIED REGENERATOR THEORY. W. F. Schalkwijk (Philips Research Labs., Eindhoven, Netherlands). Brit. Chem Eng. 5, 33-4(1960) Jan.

A simplified equation for calculating regenerator efficiency is derived. Derivation of the equation is based on the fact that most regenerators encountered in practice have very simple linear temperature changes in their central portions. (B.O.G.)

7518

HEAT TRANSFER ACCOMPANYING THE CONDENSATION OF MIXED VAPOURS. G. G. Haselden and W. A. Platt (Imperial Coll. of Science and Tech., London). Brit. Chem. Eng. 5, 37-9(1960) Jan.

A review of existing methods of calculating condensing film coefficients, at small temperature differences, for mixed vapors is presented. The necessary construction characteristics for suitable low-temperature gradient condensers are explained. An experiment using a methanol/n-propanol mixture is described. (B.O.G.)

7519

OVERALL ECONOMICS OF PLATE-FIN HEAT EXCHANGERS. W. H. Denton (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Brit. Chem. Eng. 5, 40-4; 46; 48(1960) Jan.

An analysis is made of the general economics of heat exchangers in a low-temperature gas separation plant. This involves: (1) power consumption for refrigeration; (2) power consumption to overcome pressure drop; and (3) capital cost. Criteria are developed for the optimum design of plate-fin type heat exchangers for which the costa are at a minimum. This minimum cost is shown to be an appreciable part of the total production cost in low-temperature gas separation processes. (B.O.G.)

7520

SOME FACTORS AFFECTING THE PERFORMANCE OF CONDENSER AND HEAT EXCHANGER TUBES. P. T. Gilbert (Yorkshire Imperial Metals Ltd., Leeds, Eng.). Chem. & Ind. (London) No. 28, 888-95(1959) July 11.

The factors affecting corrosion of condenser and heat exchanger tubes are discussed relative to corrosion by cooling water, petroleum products, corrosion in steam spaces, stress corrosion, and corrosion fatigue. The factors affecting operational performance are discussed relative to the efficiency with which the condenser or heat exchanger performs its function. (C.J.G.)

7521

THE RELATIONSHIP BETWEEN HEAT EXCHANGE DURING BOILING AND INNER (MOLECULAR) PRESSURE OF A LIQUID. A. I. Rychkov (Inst. of Chemical and Mechanical Engineering, Moscow). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. No. 11, 63-71(1959) Nov. (In Russian)

On the basis of experiments a simple relationship is indicated between the heat transfer of a boiling liquid and the inherent (cohesive molecular) pressure of the liquid. It is found that the effect of the inherent pressure of the liquid is higher, the greater the inherent pressure and the smaller the molecular weight of the liquid, and vice versa. The generalization of the experimental data makes it possible to derive a formula for calculating the coefficient of heat transfer to boiling liquids. (auth)

7522

THE EFFECT OF COMPRESSIBILITY ON THE COEFFICIENT OF RESISTANCE OF FRICTION DURING TURBULENT FLOW OF GAS. F. S. Voronin. Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. No. 11, 81-5 (1959) Nov. (In Russian)

In this paper a solution of the problem on influence of the compressibility on the scin-friction coefficient with turbulent flow of a gas in cylindrical tube is given. Proceeding from Nusselt's expression for turbulent shear stress and taking into account the influence of a compressibility on velocity distribution an equation for the scin-friction coefficient depending on the mach number is obtained. Comparison of the equation with experiments both with flow in cylindrical tube and with flow over bodies qives quite satisfactory coincidence. The equation can be recommended for estimation of the compressibility influence on scin-friction coefficient. (auth)

7523

HEAT EXCHANGE IN BOILING AZEOTROPIC MIXTURES. L. N. Grigor'ev, and A. G. Usmanov (Kirov Inst. of Chemistry and Tech., Kazan). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. No. 11, 114-18(1959) Nov. (In Russian)

The study of heat transfer in boiling binary azeotropic mixtures qualitatively confirms the thesis that the heat transfer mechanism in boiling mixtures differs from that in clean, monocomponent fluids. It was established experimentally that on the curve of heat transfer coefficient vs. composition it is possible to observe not only minima (as previously assumed) but also maxima. In the theoreti-

cal study of heat transfer in boiling binary mixtures Krujelin's method was used successfully. (auth)

7524

TWO-DIMENSIONAL CONVECTION FROM HEATED WIRES AT LOW REYNOLDS NUMBERS. D. C. Collis and M. J. Williams (Aeronautical Research Labs., [Fisherman's Bend, Victoria], Australia). J. Fluid Mech. 6, 357-84(1959) Oct.

Measurements of heat transfer from circular wires placed normal to a horizontal airstream were made in the Reynolds number range 0.01 to 140. The Nusselt number can be related to the Reynolds number and temperature loading by an expression of the form $N(T^m/T_\infty)^{-0.17} = A + BR^n$, where the values of n, A, and B depend on whether the Reynolds number is above or below the value for which a vortex street exists in the wake of the wire. This value of the Reynolds number ($R \doteqdot 44$) is independent of the intensity and scale of the stream turbulence. The theoretical heat transfer relation based on the Oseen approximation is approached asymptotically as $R \to 0$, provided free convection is negligible. Free convection effects diminish rapidly with increasing Reynolds number so that the orientation of the wire with respect to the vertical has a negligible influence on heat transfer except at very low velocities. For horizontal wires at very low Reynolds numbers, free convection is significant, when, roughly speaking, the Reynolds number is less than the cube root of the Grashof number. (auth)

7525

HEAT TRANSFER IN SLIP FLOW AT LOW REYNOLDS NUMBER. H. C. Levey (Univ. of Western Australia, Perth). J. Fluid Mech. 6, 385-91(1959) Oct.

The transfer of heat by forced convection from a hot wire in a low Mach number rarefied gas stream is investigated for small Reynolds numbers. A simple expression is found for the Nusselt number, and it is suggested that this has reasonable validity over a wide range of Knudsen numbers, even into the free-molecule flow régime. (auth)

7526

AN ACCURATE TRANSFER FUNCTION FOR THE DYNAMIC ANALYSIS OF TEMPERATURE AND HEAT RELEASE IN CYLINDRICAL FUEL ELEMENTS. Modesto Iriarte, Jr. (Puerto Rico Water Resources Authority, San Juan). Nuclear Sci. and Eng. 7, 26-32(1960) Jan.

A transfer function for the heat release in cylindrical fuel elements is derived. The time constants of the transfer function are given in curves as a function of the fuel element rod radius and thermal conductivity of UO_2. The average fuel element temperature, needed in connection with Doppler effect, is given as a function of the heat release transfer function parameters. Coolant temperature variations are taken into consideration. (auth)

7527

HEAT TRANSFER BY FORCED CONVECTION. D. V. Gogate and H. S. Desai (Univ. of Baroda, India). Proc. Phys. Soc. (London) 74, 770-73(1959) Dec. 1.

Heat transfer between a solid (metal sphere) and a fluid in forced convection at higher Reynolds numbers was studied. The relation between heat transfer, friction-drag force, and drag coefficient was established and the values of drag coefficient are exhibited for different Reynolds numbers. The skin drag coefficient was observed to decrease rapidly with increasing Reynolds numbers and attained a minimum value for (Re) $\sim 10^5$. The relationship between the Nusselt and Reynolds numbers was examined. (C.J.G.)

7528

EXPERIMENTAL INVESTIGATION OF DOUBLE-STREAM ELECTRON WAVE SYSTEMS. G. A. Bernashevskii, P. S. Voronov, T. I. Izumova, and Z. A. Chernov. Radiotekh. i Elektron. 4, 1666-9(1959) Oct. (In Russian)

Results are presented from experimental investigations made with a two-beam amplifier in the meter (100 to 200 mc) and 10-cm ranges. Analyses are made of the theoretical and experimental data. (R.V.J.)

Instrumentation

7529 AD-157593

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

THE EFFECT OF WALL MATERIAL AND ELECTRODE SPACING ON THE RESPONSE OF A PARALLEL-PLATE IONIZATION CHAMBER (thesis). Earle Anderson Beasley. Mar. 1958. 75p.

The Bragg-Gray principle and recently proposed modifications to it are reviewed and compared in some detail. The Bragg-Gray principle relates the energy absorbed in the walls of a small ionization chamber to the energy absorbed in the gas in the cavity, when the chamber is subjected to x or gamma radiation. A cavity ionization chamber is designed and fabricated. The chamber is irradiated with Co^{60} gamma rays, and the resulting ionization current is measured as a function of front wall thickness, wall atomic number, and front and back wall separation. The results of the experiment are compared to the existing theories. (W.L.H.)

7530 AD-214221

Controls for Radiation, Inc., Cambridge, Mass.

DEVELOPMENT OF A TACTICAL GAMMA NEUTRON DOSIMETER. Bi-Monthly Progress Report No. 4 for January 1, 1959 – February 28, 1959. I. A. Berstein, R. C. Fix, J. E. Mayer, Jr., and P. F. Russo. Mar. 10, 1959. 10p. Contract DA-18-108-405-CML-198.

Phase II of the development of a tactical gamma-neutron dosimeter was completed. Progress is reported on studies of the oxygen content of the atmosphere chamber, acid vapors in the atmosphere chamber, the sealing unit, and pH changes in the system during the scaling operation. Recommendations are given for direction in which work should proceed in the future. (W.D.M.)

7531 AD-215184

North Carolina State Coll., Raleigh.

A TIME CORRELATION TECHNIQUE FOR INVESTIGATING THREE SUCCESSIVE NUCLEAR TRANSFORMATIONS (thesis). Thomas Edward Todd. 1959. 89p.

A new technique is proposed for determining the number of true prompt triple coincidences in a time interval that arises from a radioactive decay cascade. The method requires the detection of the types of radioactivity and subsequent determination of a correlation function. It is shown that the conventional triple coincidence counting technique is a special case of this correlation method and that the correlation method is free in principle from counting rate limitations that restrict the range of usefulness of the coincidence technique. The dispersion and relative error of the correlation measurement are determined. The technique is extended to the cases of delayed emission of the second and third members of the cascade. Additional correlation functions are developed for the measurement of the half-lives of the emitters of the second and third types of radiation. (auth)

7532 AD-218856

Radiation Research Corp., New York.

VACUUM TRITIUM NUCLEAR BATTERY. Final Report [for] June 15, 1958 – December 14, 1958. Joseph Thomas-

Hazell, Bernard Caras, Robert C. Schmertz, Jr., and Stanley Grand. 64p. Contract DA-36-039-SC-78047.

A new battery design was evolved which incorporates a ceramic terminal. A complete processing schedule was developed for constructing these batteries on a special large-bore double-pumping vacuum system. Batteries were fabricated and subjected to life tests. (auth)

7533 AECU-4622

Westinghouse Electric Corp. Electronic Tube Div., Elmira, N. Y.

UNITIZED SYSTEM OF IMAGE INTENSIFIERS USING FIBER OPTICS. Progress Report [for] July to October 1959. J. S. Kalafut. 8p. Contract AT(30-1)-2176. OTS.

Various sealing techniques were investigated for a fiber optic faceplate which is to be used in the output end of a light intensifier. The vacuum side of the faceplate is to be coated with an aluminum-backed P15 phosphor and is to have an effective radiating diameter of 1 inch. The seal selected uses a 7572 devitrifying frit with glass plate and geometrical support being beveled (20°) to fit. The design of a container-support for a photocathode fiber optic faceplate to be used in a light intensifier tube with fiber optic faceplates on both the input and output is given. (C.J.G.)

7534 AERE-EL/R-1979

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

STANDARD UNITS FOR AUTOMATIC COUNTING SYSTEMS. R. L. Elliott. June 1956. 11p.

A new range of so called standard units is described which are intended to form the basis of all future automatic counting systems other than those which can be fulfilled by a simple arrangement of Timing Units and/or Printing Registers. It is written primarily for users and potential users and does not discuss circuit details. (auth)

7535 ARF-1152-3

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

AN IMPROVED NUCLEAR DENSITY GAUGE. Quarterly Report No. 1 Covering the Period from June 1 to September 1, 1959. G. M. Burgwald. Oct. 8, 1959. 20p. Contract AT(11-1)-745. OTS.

A mass gaging technique is being investigated in which the detector alternately views radiations transmitted through the test specimen and through a calibrated step wedge. Thulium-170 was used in initial investigations; however, sources of higher and lower energies are to be examined. Variations of balancing systems are discussed and results of tests using NaI(Tl) and CsI(Tl) crystals with non-commutating systems are tabulated. Commutating system's operation was tested at a chopping frequency of 10 cps. Much smoother servo operation was noted than was demonstrated by the non-commutating system. A circuit diagram of the commutating system is included. (J.R.D.)

7536 ARF-1152-4

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

AN IMPROVED NUCLEAR DENSITY GAUGE. Period covered: September 2 to October 1, 1959. G. M. Burgwald. 3p. Contract AT(11-1)-745. OTS.

Progress in development of a nuclear density gage for use in thickness and density measurements is reported. A Ross filter system for energy discrimination in the α ray region was constructed. Soller slits for collimating the radiation entering and leaving the filters so that a constant absorber thickness is seen by the radiation beam is under construction. Comments by visiting Russian scientists on the density gage and a discussion of their work in this area are included. (J.R.D.)

7537 CEA-1340

France. Commissariat à l'Énergie Atomique, Paris.

COMPTEUR G.M. ET TEMPS MORT IMPOSE. (G.M. Counter and Pre-determined Dead Time). R. Lamotte and P. Le Baud. 1959. 74p.

The principle on which a G-M counter works and the factors which lead to inaccuracies in counting are discussed. The concept of dead time, although simple when associated with the counter alone, becomes complicated as soon as an electronic dead time is introduced to meet the demands of a measurement or an experiment. The resulting dead time, due to the coexistence of these dead times created by a single motivating factor, shows up as a function of certain laws of probability. From the analysis of the various cases of possible combinations, the conditions which must be fulfilled by a system with pre-determined dead time may be determined. This leads to a method for measuring the dead time of a G.-M. counter, and the possibility of studying the latter under the utilization conditions foreseen. The principle, construction, and characteristics of two systems with pre-determined dead time are discussed. A comparison of several experimental results justifies the possibilities of a G-M counter used in conjunction with such a system. (auth)

7538 CNI-27

Italy. Comitato Nazionale per le Ricerche Nucleari, Rome.

RELAZIONE SU ALCUNE ESPERIENZE MONTE CARLO PER LO STUDIO DI UN RIVELATORE DI NEUTRONI. (Report on some Monte Carlo Experiments for the Study of a Neutron Detector). A. de Matteis and P. Giacobbe. Oct. 1959. 21p.

A Monte Carlo procedure for evaluation of some physical characteristics of a neutron detector is discussed. Three classical Monte Carlo techniques are described in some detail, a crude one and two others improved by the use of statistical weights. One of the latter techniques was found to be the more efficient and it was used for the calculations performed. The results of some of the calculations are illustrated. (auth)

7539 HW-49003(Del.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A LIQUID-CONTACT SCINTILLATION ALPHA COUNTER. U. L. Upson and P. E. Brown. Mar. 1, 1959. Decl. with deletions Nov. 17, 1959. 54p. Contract W-31-109-Eng-52. OTS.

A protected alpha-sensitive scintillation screen has been developed which can be used in direct contact with aqueous or organic liquid process streams, yielding a measure of the concentrations of alpha-emitting radioisotopes in the stream. Concentrations of 0.05 to 10 grams per liter of plutonium can be measured with a precision of about ±20 per cent; and the detection level is about 0.01 g/l. Because of the lesser sensitivity of screen to beta and gamma emissions, relatively high fission product levels can be tolerated without serious interference. In a sample cell having a low volume to active area ratio, 10 curies per liter of Cs^{137} is equivalent to only 0.01 g/l plutonium. The scintillation screen consists of a thin layer of activated zinc sulfide sandwiched between a transparent backing plate and a thin (¼ mil) Teflon film. The film is firmly bonded, by fusion, to the surface of the backing plate—a lower melting

fluorocarbon. Sample cell assemblies have been designed and tested, and prototype instruments have been installed and evaluated. The instrument appears to be very satisfactory in clean streams of less than 2.5 M nitric acid; but probably is not suited to streams of higher acid concentration, or those containing abrasive particulate matter. (auth)

7540 K-1354
Oak Ridge Gaseous Diffusion Plant, Tenn.
A CONTINUOUS BOILING POINT ANALYZER AND ITS APPLICATION TO THE HYDROGEN FLUORIDE–WATER SYSTEM. W. S. Pappas. Feb. 10, 1960. 15p. Contract W-7405-eng-26. OTS.

A simple and inexpensive instrument is described which provides a continuously recorded analysis of binary liquid or vapor mixtures by measurement of the boiling point. The instrument is insensitive to flow rate within broad limits. The response lag is less than one minute. The instrument may be applied to a sample loop of a liquid or vapor process stream, returning the sample to that process stream. This instrument has been applied to the corrosive hydrogen fluoride-water system. Precisions of ±0.5% absolute in the hydrogen fluoride concentration ranges 0 to 30% and 45 to 100% are obtained. (auth)

7541 KAPL-M-AEB-6
Knolls Atomic Power Lab., Schenectady, N. Y.
CONTROLLED ATMOSPHERE DIFFERENTIAL THERMAL ANALYSIS APPARATUS. A. E. Bibb. Jan. 4, 1960. 12p. Contract W-31-109-Eng-52. OTS.

Design and construction of a controlled atmosphere differential thermal analysis unit that will operate under vacuum, in an inert atmosphere, or in partial pressure of some gas is described. The equipment is sensitive to $\Delta T'S$ of 0.0025 MV and is accurate to ±5° in the range of room temperature to 1000°C. (J.R.D.)

7542 RADC-TR-59-74
Standard Electronics Research Corp., New York.
RADIACMETER ME–[XW-1]/G. Final Report. (Report No. 689/11). June 2, 1959. 35p. Includes Instruction Manual: TEST PROCEDURE FOR MEASUREMENT OF X-RADIATION IN THE VICINITY OF HIGH POWER COMMUNICATION AND RADAR TRANSMITTERS. Feb. 13, 1959. Project No. 5545. Contract AF30(602)-1692. (AD-215859).

An x-ray radiation detector was developed, built, and tested which measures low level radiations (less than 1 mr/hr to over 100 r/hr) in the presence of high-intensity microwave fields (over 1 watt/sq.cm.). The x radiations may take place in bursts of 1 μs to 2 ms at a repetition rate of from 30 to 500 pps. (auth)

7543 TID-3545
Technical Information Service Extension, AEC.
HOT LABORATORIES. A Literature Search. Raymond L. Scott, comp. Jan. 1960. 13p. OTS.

Included in this bibliography are 126 references on the design and construction of hot laboratories. (W.L.H.)

7544 WCAP-6038
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
NUCLEAR MATERIALS CONTROL SYSTEM (NMCS). PHASE II. A DOORWAY MONITOR FOR SAFEGUARDS USE. F. J. Arsenault. Feb. 1, 1960. 63p. Contract AT(30-1)-2176, Task I. OTS.

A doorway monitor was developed as part of a Nuclear Materials Control System (NMCS) to discourage the removal of source and special nuclear materials from a plant or work area by concealment on the person. Three methods of detection were considered: detection of the spontaneous fission neutrons from Pu^{240}, detection of the 90- and 184-kev gamma rays from U^{235}, and detection of metal shielding. (W.D.M.)

7545 WCAP-6039
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
NUCLEAR MATERIALS CONTROL SYSTEM (NMCS). PHASE II. THE FUEL ASSAY SCANNER. (A Device for the Non-Destructive Assay of Highly-Enriched Fuel Elements). R. V. Babcock and S. L. Ruby. Feb. 1, 1960. 100p. Contract AT(30-1)-2176, Task I. OTS.

For the purposes of the Nuclear Materials Control System (NMCS), a device was required which would perform a non-destructive assay of the materials in a completed reactor fuel assembly. As a practical example of such a machine, a system was developed to assay the U^{235} and poison (boron) content of high-enrichment plate-type fuel elements by comparison with a standard element. The NMCS prototype device is capable of assaying the U^{235} content of ETR and MTR fuel elements with an absolute accuracy of 0.3% (95% confidence level) by the measurement of the natural gamma activity. ETR elements containing boron may in addition, be assayed for B content with a relative accuracy of 4% by a combination of the above gamma-ray technique, thermal neutron transmission, and a volume determination. The individual measurements require less than 15 minutes. (auth)

7546 AWRE-Trans-U-58
THE FIRING OF GAS-DISCHARGE INSTRUMENTS. T. A. Sanina, A. A. Sanin, and N. R. Fedorenkova. Translated by L. J. Goodlet from Pribory i Tekh. Ekspt., No. 1, 116-19(1958). 7p.

The relationship between the duration of the firing lag of some gas-discharge instruments (neon tubes, cold thyratrons, dekatrons, etc.) and various factors (over-voltage value, frequency of repeated firing, value of the initial current, tension, etc.) was studied. The law of change in concentration of the electrons with time during the deionization period was determined by use of a photomultiplier tube. (C.J.G.)

7547 AWRE-Trans-U-59
NOISE INVESTIGATIONS AND LINEARITY TESTS ON PHOTOMULTIPLIERS. W. Hermann. Translated by W. E. Jones from Z. Naturforsch. 12a, 1006-13(1957). 14p.

The results from tests on a series of multipliers indicate that their spectrum is a minimum in the audiofrequency region (and below) and is white (heterogeneous) up to insignificant fluctuations. The calculated and measured values of noise in multipliers were found to be in close agreement, which quantitatively establishes the theoretical noise formula. From a study of the relationship between light intensity and anode current it was found that for anode currents less than 10^{-6} amp, deviations of linearity arise which exceed 1%. For anode currents greater than 10^{-6} amp, fatigue phenomena began to be significant. For higher anode currents, linear deviations for the usual operating voltages were a result of space charges. (C.J.G.)

7548 AWRE-Trans-U-60
A HIGH-TENSION, MULTIPLE-PULSE VOLTAGE GENERATOR. A. P. Komar and N. N. Chernov. Translated by J. L. Goodlet from Pribory i Tekh. Ekspt. No. 1, 82-4 (1958). 5p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 12528.

7549 CEA-tr-R-754

APPAREIL POUR MESURER L'ÉPAISSEUR DES PELLICULES. (Apparatus to Measure the Thickness of Films.) V. S. Aleksandrov and S. L. Epshtein. Translated into French by B. de Trezvinsky from Zavodskaya Lab. 24, 1159-60(1958). 5p.

The ETP-3 continuous radiometric thickness gage is described. It is used for organic films of density 0.8 to 3 g/cm^2 and thickness 3 to 30 μ with a C^{14} source, and 30 to 90 μ with a Tl^{204} source. Its field of measurement is 4 cm^2. (T.R.H.)

7550 SCL-T-292

FIRING TIME OF ANODE OF AN IGNITRON. Naohei Yamada, Yoshitaka Ikeda, and Yoshiyuki Iida. Translated by Noburu Hiraga (Sandia Corp.) from Denki Gakkai Zasshi 75, 465-70(1955). 25p. JCL.

Results of ignitron anode firing time measurements are presented. Irregularities were found and it was established that these differ according to the shape of the discharge path vapor density. Firing time deviation from the mean value becomes greater when the discharge path is more narrowly curved or when the temperature is lower. Other factors affecting the irregularity and length of firing time are discussed. (J.R.D.)

7551

SIMPLE PARALLEL PLATE IONIZATION CHAMBER FOR THE UNDERGRADUATE NUCLEAR PHYSICS LABORATORY. George E. Bradley (Western Michigan Univ., Kalamazoo). Am. J. Phys. 28, 163-4(1960) Feb.

The instrument described was built in an aluminum roasting pan and was found to be useful in simple demonstrations in general physics and in undergraduate nuclear laboratories. The instrument has a sensitive volume of 75 cubic inches and a collection current sensitivity of 10^{-13} amp. This current corresponds to approximately 10^6 ion pairs per second, or approximately ten alpha particles per second. (B.O.G.)

7552

DEMONSTRATION BETA SPECTROMETER. George E. Bradley (Western Michigan Univ., Kalamazoo). Am. J. Phys. 28, 164-5(1960) Feb.

The apparatus described may be used to demonstrate the continuous beta spectrum and the electron conversion lines. It consists of a small electromagnet with 4-in.-diam. pole faces, a vacuum chamber of 3.0-cm curvature radius, and a halogen-quenched Geiger tube with a thin mica window (probably 2.5 mg/cm^2) and a threshold of 500 volts. A 20 microcurie radioactive source was evaporated on a thin Mylar base in this instance. For demonstration purposes current may be measured with sufficient precision with a 1.5 amp full scale meter. (B.O.G.)

7553

FAST-NEUTRON SPECTROSCOPY. B. V. Rybakov and V. A. Sidorov. Translation of Suppl. No. 6 of Atomnaya Energ., 1958. New York, Consultants Bureau, Inc., 1960. 127p. $17.50.

This book was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 20492.

7554

THE MEASUREMENT OF CENTI- AND MILLI-MICROSECOND. J. Piesch. Atompraxis 5, 482-7(1959). (In German)

The procedure and equipment for measuring time intervals of 10^{-6} to 10^{-9} seconds are discussed. The interval is marked by two electric signals. First there is a report on the proper formation and amplification of these signals; then three procedures are described on the basis of which the interval can be clearly correlated with other factors which can be measured by relatively simple known methods. According to procedure I the interval is expressed in tension values; procedure II consists of measuring the cable distance through which an impulse flows during the interval. If the process to be measured is repeated periodically, procedure III can be used to extend the interval by reducing the series frequency, i.e., the interval can be multiplied by a constant factor. (auth)

7555

MEASUREMENT OF TINPLATE THICKNESS USING FLUORESCENT X-RAYS EXCITED BY A RADIOACTIVE SOURCE. J. F. Cameron and J. R. Rhodes (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Brit. J. Appl. Phys. 11, 49-52(1960) Jan.

Using tritium bremsstrahlung as an x-ray source and a thin-windowed scintillation counter as a detector, a method of measuring the thickness of tinplated steel over the range 0 to 1.55 μ (1.00 lb per basis box) was developed. The technique depends on absorption of the iron fluorescent x-radiation by the tin layer. An accuracy of 1% can be obtained with 95% confidence in a counting time of 30 sec. (auth)

7556

A THREE-ELECTRODE IONIZATION CONDENSER CHAMBER. J. Cederlund (Radiofysiska Institutionen, Lund, Sweden). Brit. J. Radiol. 33, 105-9(1960) Feb.

A special ionization chamber has been described which has three electrodes and two air volumes. The device may be used to measure very small doses where the dose is proportional to a voltage in contrast to a conventional chamber where the dose is proportional to the difference between two almost equal voltages. The device may be used to measure large doses. No prior knowledge of the dose expected is required since the measuring range may be selected after the chamber has been irradiated. (auth)

7557

A GRAPHITE/GRAPHITE THERMOCOUPLE FOR HIGH TEMPERATURES. A. R. Ubbelohde, L. C. F. Blackman, and P. H. Dundas (Imperial Coll. of Science and Tech., London). Chem. & Ind. (London) No. 19, 595-6(1959) May 9.

The limiting value in the a-axis direction for ideal graphite crystals was determined to be $-3\mu v$ per °C at 20°C. The design of a thermoelectric power unit for high-temperature work is given. The thermo-junction at the hot end is formed between pyrolytic graphite highly oriented with respect to the a-axis and polycrystalline graphite which was exposed to 2500°C for several hours. The bulk density of the material is 1.6 g/ml. The voltage output of the apparatus is given for exposure of the hot junction of the couple to 0 to 2400°C. (C.J.G.)

7558

MEASURING TECHNIQUES OF THE β RADIATION LONGITUDINAL POLARIZATION AND γ RADIATION CIRCULAR POLARIZATION. A. Fasana (Istituto di Fisica del Politecnico, Milan). Energia nucleare (Milan) 7, 1-10 (1960) Jan. (In Italian)

A survey of the most recent developments of β and γ polarization detection techniques is given. The different effects which depend on the polarization and which may therefore be used as polarization analyzer are briefly mentioned. At the same time an example of its application is given for each. (auth)

7559

DEVELOPMENTS AND FUTURE AIMS OF NEUTRON

DIFFRACTION. G. L. Bacchella (Centra Informazioni Studi Esperienze, Milan). Energia Nucleare (Milan) 7, 11-22(1960) Jan. (In Italian)

A short outline of the physical principles of neutron diffraction is given in this review; similarities between neutron diffraction and x-ray diffraction are also summarized. Experimental techniques are described and the most interesting future developments are considered. (auth)

7560

MEASUREMENT OF THE EFFECT OF A SIMPLE PASSIVATION PROCESS FOR ORGANIC VAPOUR GM COUNTERS. E. Gatti, G. Redaelli, and R. Renzoni (Centro Informazioni Studi Esperienze, Milan). Energia nucleare (Milan) 7, 23-30(1960) Jan. (In English)

A simple method for the cathode passivation of GM counters is described. This method of treating nullifies permanently the photoelectric sensitivity visible in the field of the GM counters. Measurement and evaluations of comparison between the treated and the non-treated counters have been effected. (auth)

7561

RADIATION-TOLERANT ELECTRONIC EQUIPMENT. James R. Burnett (Bendix Aviation Corp., Detroit). IRE Trans. Nuclear Sci. NS6, 12-15(1959) Dec.

A study was made of electronic equipment capable of operating in radiation fields for long periods of time. To date the file contains radiation effects data on 1100 electronic components and materials. A color code based on how much nuclear radiation a device can be exposed to and still give "satisfactory performance" is used to mark the cards of the components. As a result of this compilation, several pieces of complex electronic equipment were subjected to a component interchange-replacement of radiation-sensitive with radiation-resistant components. An ARN-32 aircraft marker beacon receiver was modified and it operated for more than 370 hours during a 55 day period. After the ARN-32 was subjected to an epicadmium flux of 3×10^{17} nvt the crystal had drifted but the unit was still operating within pertinent military specifications. (B.O.G.)

7562

TRANSISTOR-DRIVEN BEAM SWITCHING TUBE DECADE COUNTER. Richard H. Graham (Univ. of Calif. Livermore). IRE Trans. Nuclear Sci. NS6, 16-20(1959) Dec.

A description is presented of an electrical readout decade counter employing the magnetron beam switching tube with transistor drive. Double-pulse resolution is 1 μsec. The unit will accept a variety of transistor types, and will tolerate supply voltage variations of ±20 per cent at ambient temperatures up to 60°C. A "Pixie" neon indicator is driven without the use of additional transistors. A readout circuit for printer or punched paper tape is presented. (auth)

7563

A STACK EFFLUENT RADIOISOTOPE MONITOR. R. A. Harvey (General Electric Co., Richland, Wash.). IRE Trans. Nuclear Sci. NS6, 20-28(1959) Dec.

A system for simultaneously measuring and indicating each of several different radioisotopes in the stack effluent of an atomic energy facility is described. Analog computer techniques are employed for the solution of simultaneous equations and for the counting and scaling. Two types of presentations are included for the output. The total amounts of the radioisotopes emitted to the atmosphere are indicated on registers, and marks are recorded on a moving chart each time specific quantities are emitted. The emission quantity of each isotope is indicated by a register and by a single channel on the chart recorder. (auth)

7564

APPARATUS FOR MEASURING THERMAL CONDUCTIVITY OF CERAMIC AND METALLIC MATERIALS TO 1200°C. W. H. Sutton (General Electric Co., Philadelphia). J. Am. Ceram. Soc. 43, 81-6(1960) Feb.

A steady-state apparatus for measuring thermal conductivity by a direct method, viz., water calorimetry, is described. The accuracy of measurement is about 1 to 3% in the temperature range 30° to 300°C and about 3 to 10% in the range 300° to 1200°C. The samples are rods 9 in. long and $\frac{3}{4}$ in. in diameter, although smaller sizes can be accommodated. One feature of the design is that the sample thermocouples can be plugged into the unit. Curves for samples of alumina, stainless steel, and graphite are included. (auth)

7565

CONTRIBUTION TO THE STUDY OF THE AGING PHENOMENON OF SELF-LIMITING GEIGER-MUELLER COUNTERS. F. E. M. Lox and G. P. Van der Kelen (Faculteit der Wetenschappen, Ghent). J. phys. radium 20, Suppl. No. 12, 131A-38A(1959) Dec. (In French)

As an unambigous criterion for determining the deterioration of a GM counter tube, the value $(\Delta V_l / \Delta V_H)$, the change in pulse-height as a function of the applied high-voltage, has been defined. A study was made of the relative importance of the three main constituents of a GM counter on its characteristics. A systematic study was made of the influence of anode, cathode, and the gas-phase composition. It is shown that the aging of a counter can be ascribed to two different factors: changes of the gas phase that influence mainly the plateau characteristics and changes on the anode surface that cause a gradual decrease of the value $(\Delta V_l / \Delta V_H)$. This is taken as evidence that the changes of the anode surface influence the multiplication process. (auth)

7566

APPARATUS FOR MEASUREMENT OF RADIOACTIVITY OF HUMAN BODY. A. Lansiart and L. Jeanmaire (Commissariat a l'Énergie Atomique, Paris). J. phys. radium 20, Suppl. No. 12, 174A-6A(1959) Dec. (In French)

A whole-body counter is described. It employs both NaI crystals and liquid scintillators for maximum utility. (T.R.H.)

7567

THICKNESS MEASUREMENTS ON SHEETS AND PIPES AND DETERMINATION OF PRECIPITATIONS IN PIPES BY MEANS OF GAMMA BACKSCATTERING. Th. Franke. Kerntechnik 1, 85-7(1959) Sept. (In German)

A simple apparatus for thickness measurements on sheets and pipes is described. The apparatus works with the gamma backscattering of Cs^{137}, in which the radiation sources are shielded at the detector by a heavy metal cone. Thickness measurements are possible on steel sheets and pipes up to 18 mm. The measurement accuracy is smaller with increasing steel thickness. With a wall thickness of 15 mm steel the accuracy is 2 to 3%. With the device precipitations in pipes can be detected, although for this the wall thickness must not exceed 10 mm steel. The accuracy of the measurement depends on the thickness of the pipe walls and on the specific density of the surface. An accuracy of 1 to 4 mg/cm^2 is possible. (tr-auth)

7568

NEUTRON FLUX MEASUREMENTS IN THE REACTOR.

H. Walther (z. Z. Reaktorstation Saluggia, Sorin, Italy). Kerntechnik 1, 105-15(1959) Oct. (In German)

The utilization of the probe activation method for neutron flux measurements is described. The physical basis and the practical methods for the absolute measurements of thermal, resonance, and fast fluxes are explained and illustrated. The performance of such measurements on the Munich Research Reactor is described. (tr-auth)

7569

DENSITY AND THICKNESS MEASUREMENTS WITH SEALED RADIOACTIVE IRRADIATORS. J. Bosch (Frieseke and Hoepfner GmbH, Erlangen-Bruck, Ger.). Kerntechnik 1, 174-82(1959) Dec. (In German)

The economic significance of density and thickness measurements is briefly reviewed, and the principle of radio thickness gages is described. The absorption of beta and gamma radiation is chiefly used as the effect to be measured. Ionization chambers, scintillation counters, and rarer counter tubes are used for radiation measurements. The ionization chamber in connection with a vibrating condenser amplifier has a wide application. Commercial devices and the results obtained with them are discussed. The plastic, paper, metal rolling, and oil industries use radio thickness gages. (tr-auth)

7570

THE IRON-FREE DOUBLE-FOCUSING BETA SPECTROMETER OF THE INSTITUTE OF NUCLEAR RESEARCH. C. de Vries (Instituut voor Kernphysisch Onderzoek, Amsterdam). Ned. Tijdschr. Natuurk. 25, 256-61(1959). (In Dutch)

The construction and performance of an iron-free double-focusing beta spectrometer are described. The field measurements are tabulated, and typical spectra obtained are shown. (J.S.R.)

7571

TINY SEMICONDUCTOR IS FAST, LINEAR DETECTOR. Stephen S. Friedland and James W. Mayer (Hughes Aircraft Co., Culver City, Calif.) and John S. Wiggins (Hughes Aircraft Co., Newport Beach, Calif.). Nucleonics 18, No. 2, 54-6; 58-9(1960) Feb.

By a shallow diffusion (less than 1 μ) of phosphorus into p-type high-resistivity silicon, a device was made which acted as particle detector and energy spectrometer for heavy charged particles (protons, alpha particles, fission fragments), and preliminary results show that beta detection was achieved. With suitable reverse bias the devices produce a linear response to protons to 4.5 Mev and to alpha particles to 20 Mev. Pulse-height distributions with an energy resolution of 0.6% at 6 Mev were measured. The response time is less than that of the circuits with which they are measured ($< 3.5 \times 10^{-9}$ sec). The detector is 0.5 mm thick and has a sensitive area of about 2 mm diameter. Detectors having larger areas are being fabricated and their properties investigated. (B.O.G.)

7572

SEMICONDUCTOR FISSION PROBE. Robert Steinberg (National Aeronautics and Space Administration, Cleveland). Nucleonics 18, No. 2, 85(1960) Feb.

The construction of series-connected uranium-235-coated silicon pn-junction wafers is explained. This provides a compact probe for flux mapping in a low-power reactor. Counting efficiencies of 10^{-7} to 10^{-4} counts/n/cm^2 were measured for single wafers, while the sensitivity of a detector of 10 wafers in series was 1.0×10^{-3} counts/n/cm^2 and ~0.75 mv pulse height (~25% decrease from single-wafer pulse height). It is felt that the useful limit of series circuitry will be an efficiency of 1×10^{-2} counts/n/cm^2. (B.O.G.)

7573

DETERMINATION OF EQUATION COEFFICIENTS FOR PROPAGATION CONSTANTS IN A DELAY SYSTEM WITH AN ELECTRON BEAM. L. N. Loshakov and J. N. Pchelnikov. Radiotekh. i Elektron. 4, 1670-7(1959) Oct. (In Russian)

A new calculation method is suggested for determining the coefficients of algebraic equations for propagation constants based on the ratio of electronic and dispersion equations of delaying systems with electron beams (the solution of the latter is not required). (R.V.J.)

7574

ELECTRON MULTIPLIERS WITH A GRID DIRECTING ELECTRON BEAMS. P. V. Timofeev and E. G. Kormakova (Lenin All-Union Electrotechnical Inst. of the Order of Lenin). Radiotekh. i Elektron. 4, 1678-84(1959) Oct. (In Russian)

Descriptions are presented of electron multipliers with directing grids, high amplification factors, large anode currents, small dark current, and high stability. Their real tube noises approach assigned theoretical magnitudes. (tr-auth)

7575

FLUCTUATIONS IN A REFLEX KLYSTRON. E. N. Bazarov and M. E. Zhabotinskiĭ. Radiotekh. i Elektron. 4, 1685-92(1959) Oct. (In Russian)

The fluctuations in a reflex klystron performing with auto-oscillation, synchronization, resonance of the second order, and synchronized overtone were theoretically analyzed using a system of symbolic equations and correlation theory. Equations are derived for amplitude fluctuations and oscillation spectra. (tr-auth)

7576

FAST NEUTRON TIME-OF-FLIGHT SPECTROMETER. G. C. Neilson, W. K. Dawson, and F. A. Johnson (Suffield Experimental Station, Ralston, Alberta). Rev. Sci. Instr. 30, 963-75(1959) Nov.

A versatile neutron time-of-flight spectrometer suitable for use in the millimicrosecond region is described. Either the rf beam deflection method or the gamma coincidence method is used to provide the zero time indication. Details of these methods, along with spectra obtained for some (d,n) reactions, are given. The two systems are compatible and make use of the same simple time-to-pulse-height converter. The dependence of the decay time of a liquid scintillator on the specific ionization of the detected particle was used to make the neutron detector insensitive to gamma-rays. (auth)

7577

LIQUID HYDROGEN TARGETS OF ADHESIVE-BONDED MYLAR PLASTIC. Roy S. Hickman, Robert W. Kenney, Robert C. Mathewson, and Richard A. Perkins (Univ. of California, Berkeley). Rev. Sci. Instr. 30, 983-5(1959) Nov.

Vacuum-tight cryogenic containers can easily be made from Mylar plastic sheet and metal, or from Mylar alone, for use in vacuum-insulated liquid hydrogen target assemblies. Mylar is bonded very firmly to metals or to itself by an Epon-Versamid mixture or by Armstrong A-4. These adhesives maintain strong vacuum-tight joints through-out the temperature range from 300 to 4°K. Mylar sheet proved satisfactory as vacuum-window material for beam ports. Fabrication of these structures is described in detail, and explosion safety measures are mentioned.

Examples are given of structures which were used or tested, with data on the ultimate strength of each expressed as the internal pressure required to rupture it. Helium leak testing must be carried out at 77°K or below, because Mylar is relatively impermeable to helium only at low temperatures. The primary electron beams commonly obtained from electron linear accelerators are sufficiently intense to cause Mylar beam windows to fail under vacuum loading, probably because of radiation damage. (auth)

7578

TIME ANALYZER UTILIZING THE ARGONNE TYPE 256-CHANNEL PULSE-HEIGHT ANALYZER. J. F. Whalen, J. W. Meadows, and C. H. Nelson (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 30, 991-4 (1959) Nov.

A time analyzer was designed which is capable of utilizing the memory of any multichannel analyzer which employs pulse height to time conversion or any similar instrument. The circuit described was specifically adapted for use with the Argonne type 256-channel analyzer. Channel widths from 1 μsec to >38 μsec are possible with a minimum dead time of 38 μsec. (auth)

7579

AUTOMATIC CONTROL AND PROGRAMMING SYSTEM FOR SINGLE CRYSTAL DIFFRACTOMETRY. F. Langdon and B. C. Frazer (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 30, 997-1003 (1959) Nov.

An automatic control and programming system for the collection of single crystal diffraction data is described. The system was designed for a neutron diffractometer, but it could easily be adapted for use with x-rays. (auth)

7580

MILLIMICROSECOND DISCRIMINATOR. David F. Swift and Victor Perez-Mendez (Univ. of California, Berkeley). Rev. Sci. Instr. 30, 1004-6(1959) Nov.

A discriminator circuit for use with millimicrosecond counting equipment is described here. The circuit utilizes a diode voltage comparator which drives a secondary-emission tube univibrator after amplification. Two shaped outputs are provided: one, of short duration, for use with 10-Mc scalers; and another longer pulse for microsecond scalers. The main characteristics of this unit are its good response to pulses as short as 3 m μsec and the fast recovery time, which is less than 0.1 μsec at the fast output. (auth)

7581

ABSOLUTE METHOD OF MEASURING MAGNETIC SUSCEPTIBILITY. Arthur Thorpe (Howard Univ., Washington, D. C.) and Frank E. Senftle (U. S. Geological Survey, Washington, D. C.). Rev. Sci. Instr. 30, 1006-8(1959) Nov.

An absolute method of standardization and measurement of the magnetic susceptibility of small samples is presented which can be applied to most techniques based on the Faraday method. The fact that the susceptibility is a function of the area under the curve of sample displacement versus distance of the magnet from the sample, offers a simple method of measuring the susceptibility without recourse to a standard sample. Typical results on a few substances are compared with reported values, and an error of less than 2% can be achieved. (auth)

7582

THREE-DIMENSIONAL SCINTILLATION DOSIMETER. Garth L. Olde and Eric Brannen (Univ. of Western Ontario, London, Can.). Rev. Sci. Instr. 30, 1014-16(1959) Nov.

A dosimeter for electron beams was constructed which utilizes the luminescence of plastic phosphors under electron bombardment. A phosphor, in sheet form, was placed in a Lucite medium and the luminescence of a small volume of the phosphor was focused on a photomultiplier. By scanning the phosphor, the three-dimensional dose distribution within the medium was determined. Special attention was paid to obtaining the dose close to the surface of the medium by which the electron beam entered. (auth)

7583

TEMPERATURE EFFECTS IN NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY. George Slomp (Upjohn Co., Kalamazoo, Mich.). Rev. Sci. Instr. 30, 1024-7 (1959) Nov.

The effect of temperature on the stability of the Varian V-4300-2 NMR spectrometer was investigated. The spectrometer was most sensitive to changes in room-air temperature. A change of 0.3°C per minute caused a spectrometer drift of about 20 cps per minute. A change of 0.1°C per minute in temperature of magnet cooling water caused a spectrometer drift of 1 cps per minute. Enclosing the magnet served to minimize effects of air temperature changes but amplified the effects of water temperature changes. Satisfactory control was attained by running the refrigeration units continuously and regulating the temperatures by controlling the suction pressure on the evaporators. Under these conditions spectra were reproducible to within $\frac{1}{2}$ cps. (auth)

7584

HIGH-POWER PULSE STEEPENING BY MEANS OF EXPLODING WIRES. G. Sargent Janes and H. Koritz (Avco-Everett Research Lab., Everett, Mass.). Rev. Sci. Instr. 30, 1032-7(1959) Nov.

A circuit technique is described which reduces the rise times of high-power pulses by means of exploding wires. This circuit is a nonlinear lumped parameter transmission line. The magnetic energy is stored in the interstage lead inductances and rapidly transferred into (or more correctly, shared with) succeeding stages by the vaporization of exploding wire resistive fuse elements connected in shunt between the leads. In our case, each of three resistive fuse elements consisted of 20 to 50 parallel 0.001-in. diam copper wires held in place across a 2-in. gap with pressure sensitive tape. An empirically determined arrangement is described wherein we have increased the maximum rate of current rise from 300,000 amp/μsec to 800,000 amp/μsec. Using this technique, a magnetic field of 10,000 gauss is built up in 0.15 μsec throughout a volume 4 cm in length and 10 cm in diameter. It is shown that the best results are obtained with high conductivity fuse materials such as copper or aluminum. Similarity theorems are presented for the design of pulse steepening elements for use with circuits having similar pulse shapes but different energies and characteristic impedances. (auth)

7585

NONPROPORTIONALITY IN BAYARD-ALPERT IONIZATION GAUGE AND THE ULTIMATE VACUUM DETERMINATION OF DIFFUSION PUMPS. Y. Mizushima and Z. Oda (Nippon Telegraph and Telephone Public Corp., Tokyo). Rev. Sci. Instr. 30, 1037-41(1959) Nov.

The nonproportionality between the ion current and the electron current in a Bayard-Alpert ionization gage is systematically examined and theoretically treated. The effective pumping speed is so modified as to include the effect of back diffusion of oil vapor from the diffusion pump and the contribution of ionization pumping. The

theory is experimentally verified in some respects to deduce a new criterion for the maximum attainable vacuum with the diffusion pump. Oil and mercury diffusion pumps are compared to deduce the superiority of mercury pumps for obtaining "ultra-high" vacuum. The best vacuum (in normal working conditions) is $10^{-9} \sim 10^{-8}$ mm Hg with oil and 10^{-11} mm Hg with mercury. (auth)

7586

HIGH-SPEED TURBINE-DRIVEN ROTATING MIRRORS: NOTES ON DESIGN, CONSTRUCTION, AND PERFORMANCE. Berlyn Brixner (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 30, 1041-8(1959) Nov.

Described in detail are the main features of design and fabrication which contribute to the production of the reliable long-lived drives of several styles of high-speed turbine-driven rotating mirrors. The subjects analyzed are steel mirror fabrication, which includes heat treatment; mirror balancing and surface finishing techniques; important bearing design features; construction of the turbine; and performance of selected models. (auth)

7587

RADIATION EXPOSURE TIMER FOR 12-VOLT OPERATION. B. L. Blanks (Emory Univ., Atlanta). Rev. Sci. Instr. 30, 1049(1959) Nov.

A diagram of the circuits used in controlling and regulating a radiation exposure timer utilizing a 12-volt system is given. Regulation of the circuit is 0.5% for input voltage variation from 10 to 15 v and 0.5% for temperature variation from 10 to 60°C, which gives an over-all accuracy of 1%. (C.J.G.)

7588

USE OF CESIUM CHLORIDE FOR TRANSMITTING HIGH PRESSURES AT HIGH TEMPERATURES. H. W. Schamp, Jr. (Univ. of Maryland, College Park). Rev. Sci. Instr. 30, 1051-2(1959) Nov.

The use of cesium chloride crucibles to transmit high pressures at high temperatures is described. The pressure apparatus design of Boyd was utilized. The method should be useful for diffusion measurements to pressures as high as 30,000 atm. and temperatures above 1000°C. (C.J.G.)

7589

USE OF THE FOUR-INCH LIQUID HYDROGEN BUBBLE CHAMBER AS A FAST-NEUTRON SPECTROMETER. Harold E. Adelson, Hoyt A. Bostick, Burton J. Moyer, and Charles N. Waddell (Univ. of California, Berkeley). Rev. Sci. Instr. 31, 1-10(1960) Jan.

The 4-in. hydrogen bubble chamber was used as a neutron spectrometer in the 5- to 30-Mev region. A fast data-reduction system for the analysis of the recoil-proton tracks was developed, utilizing a commercial electronic coordinate-measuring device, the IBM punch-card system, and the IBM 650 digital computer. The resolution of the entire spectrometer system was determined by measuring the monoergic (14.1-Mev) neutron spectrum from the $t(d,n)He^4$ reaction with different neutron collimators. The full width at half maximum of the measured peak was 10% of the peak energy. (auth)

7590

TIME-TO-PULSE HEIGHT CONVERTER OF WIDE RANGE. Joachim Fischer and Arne Lundby (European Council for Nuclear Research, Geneva). Rev. Sci. Instr. 31, 10-14(1960) Jan.

A time-to-pulse height converter covering the range from millimicroseconds to minutes is described. A simple 5-component passive circuit for scanning times above 50 μsec is included also. The converters can measure several events per time scan related to one starting event. They are designed as plug-in units for an oscilloscope, and utilize its sweep and other circuits. The use of the converters is discussed and includes scanning of negative time and inverted operation for reduction of counting losses. Notes on testing, calibration, and dead times are given, as well as examples of nuclear experiments to which they were applied. (auth)

7591

SAMPLING OSCILLOSCOPE FOR MILLIMICROSECOND PULSES AT A 30-Mc REPETITION RATE. Arnold S. Farber (Columbia Univ., New York). Rev. Sci. Instr. 31, 15-17(1960) Jan.

A sampling oscilloscope with a rise time of 3×10^{-10} sec is described. It may be used with carrier or noncarrier periodic signals having a high fixed repetition rate. A coincidence circuit employed in the device for displaying the envelope of 1-mμsec bursts of 10-kMc energy is presented. (auth)

7592

GAMMA-RAY PINHOLE TELEVISION CAMERA. Abraham E. Cohen (Army Signal Research and Development Lab., Fort Monmouth, N. J.). Rev. Sci. Instr. 31, 29-31 (1960) Jan.

An experimental camera was devised capable of viewing a gamma-ray or x-ray source both statically and dynamically with a kinescope readout suitable for quantitative measurements. Experiments are described indicating sensitivities to x-rays of about 1 to 2 r/hr. (auth)

7593

ENERGY LOSS SPECTRA FOR GAMMA RAYS IN NaI. W. F. Miller and William J. Snow (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 31, 39-45(1960) Jan.

Energy loss spectra for gamma rays incident on sodium-iodide crystals were calculated by the Monte Carlo method. The calculations were carried out for point sources, disk sources, and broad parallel beams of monoenergetic gamma rays varying in energy from 0.279 to 8 Mev. The crystals considered were right circular cylinders varying from small crystals of height and diameter one inch to large crystals of height and diameter 6 inches. Also calculated simultaneously with the energy loss spectra were the efficiencies and total absorption fractions. (auth)

7594

FAST COINCIDENCE CIRCUIT FOR SLOW PULSES. J. E. Draper and A. A. Fleischer (Yale Univ., New Haven). Rev. Sci. Instr. 31, 49-52(1960) Jan.

A circuit is described which permits the timing of slow pulses (e.g., 300-mμsec rise time) to good precision (e.g., ±3 mμsec) over a wide range of pulse heights (e.g., 6 to 120 v) and at high counting rates (average separation ≥4 μsec). This is useful particularly in coincidence spectroscopy with NaI(Tl) scintillators. (auth)

7595

TEMPERATURE-REGULATED IGNITION SOURCE. John Preston and Leland E. Ashman (Arthur D. Little, Inc., Cambridge, Mass.). Rev. Sci. Instr. 31, 53-8(1960) Jan.

The temperature controller described here is capable of heating a fine wire (of the order of a few mils in diam) to some temperature between 700°C and the melting temperature, and holding the temperature constant to within a few degrees. The detector is a photomultiplier that monitors radiation from the center of the wire; changes in radiation result in compensating changes in the current. The con-

troller responds within a millisecond to sudden changes in the environment of the wire. This rapid response is useful for detecting the onset of ignition in reactive gases and perhaps for measuring the thermal properties of non-reactive gases. (auth)

7596

USE OF FIBER LIGHT PIPES WITH MAGNETICALLY DRIVEN SHOCK TUBES. Eugene Field and Eldred F. Tubbs (Sylvania Electric Products, Inc., Mountain View, Calif.). Rev. Sci. Instr. 31, 64(1960) Jan.

Glass-fiber light pipes were used to minimize the electrically driven shock tube. These pipes eliminated the problem of optical alignment. The flexibility of the light pipes permits removal from the shock tube for bakeout with a minimum of inconvenience. (B.O.G.)

7597

SEALING PHOTOMULTIPLIERS TO LIQUID SCINTILLATOR WITH INDIUM GASKETS. R. C. Block and R. H. Ward (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 31, 66-7(1960) Jan.

A method is presented for directly coupling a photomultiplier to a liquid scintillator by means of an indium wire gasket. The gasket ring and flange are machined such that when they are tightened, the indium wire gasket "flows" and fills the space between the flange and the photomultiplier. The system was found to be vacuum tight when the radial gap between the photomultiplier and flange-gasket ring assembly was as great as 0.080 in. (B.O.G.)

7598

PRESSURE CONTACTOR WITH MYLAR ELEMENT. J. C. Muirhead and D. W. Lecuyer (Suffield Experimental Station, Ralston, Alberta). Rev. Sci. Instr. 31, 67-8(1960) Jan.

Considerations are given for a gage which is capable of detecting the arrival of shock fronts from high explosive charges. Resultant tests indicated that 0.5-mil spacing gave satisfactory response times of 5 μsec or less. Replacement of the Mylar element after each exposure was recommended for best performance. (B.O.G.)

7599

NUCLEAR RESONANCE OSCILLATOR STABILIZED BY A MAGNETIC FIELD. Donald W. Feldman (Univ. of California, Berkeley). Rev. Sci. Instr. 31, 72(1960) Jan.

An electrical feedback system for locking NMR marginal oscillator onto a resonance signal was devised, allowing the continuous and accurate monitoring of a magnetic field by monitoring the frequency of the oscillator. The resonance lock-in circuit enables the measurement of the frequencies of nuclear magnetic resonance lines with respect to the frequency of an oscillator locked to the magnetic field, thus eliminating the necessity of compensating for magnet drift. (B.O.G.)

7600

ROOM TEMPERATURE OPERATED p-n JUNCTIONS AS CHARGED PARTICLE DETECTORS. S. S. Friedland, J. W. Mayer, and J. M. Denny (Hughes Aircraft Co., Culver City, Calif.). Rev. Sci. Instr. 31, 74-5(1960) Jan.

Surface barrier detectors were fabricated from 10-ohm-cm p-type silicon with a diffused phosphorus n-layer parallel to the active surface and 12 μ (Mark I) or 1 μ (Mark II) below the surface. The pulse-height spectra for various alpha emitters obtained with the Mark I detector are presented. An extrapolation of the Mark I data to zero corresponds to about 3 Mev, which is consistent with the energy loss of an alpha particle in 12 μ of silicon. The measurement of the precise shape of the Mark II detector curve was not performed. (B.O.G.)

7601

HODOSCOPE DESIGN TO MINIMIZE PHOTOMULTIPLIER USE. Luis W. Alvarez (Univ. of California, Berkeley). Rev. Sci. Instr. 31, 76(1960) Jan.

A binary hodoscope is described which requires 10 photomultipliers to determine which of the 1024 squares in a 32- by 32-element hodoscope was hit by a particle. Using a normal hodoscope, 64 photomultipliers are required to obtain the same information. The nonambiguous hodoscope unit is designed such that errors due to an inclination of track are avoided. (B.O.G.)

7602

DEVICE FOR MEASURING PARAMETERS OF RADIATION RECEIVERS. A. F. Malnyev and L. S. Kremenchugskii (Kremenchugsky) (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Ukraïn. Fiz. Zhur. 4, 522-3 (1959) July-Sept. (In Ukrainian)

Descriptions are given of a device for determining the effective noise value, the relative sensitivity to modulated radiation, the threshold sensitivity, the spectral distribution of effective noise, and the dependence of effective noise value on the current that passes through the bolometer. The device is applicable to measurements in the frequency range 3 to 50 Gc. (R.V.J.)

7603

APPARATUS FOR STUDYING NUCLEAR QUADRUPOLE RESONANCES USING ZEEMAN MODULATION. V. C. Grechishkin. Vestnik Leningrad. Univ., Ser. Fiz. i Khim. No. 22, 19-23(1959). (In Russian)

A simple device for direct observation of nuclear quadrupole resonance on an oscilloscope screen without any phase detector is described. A super-regenerative oscillator and Zeeman modulation were applied. High sensitiveness and simplicity were achieved in the study of the coupling character in a number of molecular crystals. (auth)

7604

DESCRIPTION OF A GAUGE FOR ULTRA-HIGH VACUA AND REMARKS ABOUT ULTRA-HIGH VACUA TECHNIQUES FOR ALL-METAL MOUNTINGS. K. G. Muller. Vide 14, 250-9(1959) July-Aug. (In French and English)

A description is given of a gage for measuring pressures below 10^{-7} torr. The gage employs an Alpert-type ionization tube. For low emission currents and grid voltages of 100 to 150 v there is almost no x-ray effect. The precision of the gage is ±10%. Ultra-high vacua techniques for all-metal mountings are discussed. (C.J.G.)

7605

NATURAL EQUIVALENT CIRCUIT AND HYBRID-PARAMETERS OF JUNCTION TRANSISTOR. Cheng Chung-Chih and Lee Gin-Lin (Inst. of Physics, Academia Sinica, Peking). Wu Li Hsüeh Pao 15, 475-506(1959) Sept. (In Chinese)

The relationships between small-signal h-parameters and elements of the natural equivalent circuit of the common emitter configuration of junction transistors were studied. From experimental results of h-parameters of two typical alloyed PNP transistors (2N 104 and П-6 transistors), the relationship of h-parameters and elements of a natural equivalent circuit vs operating frequency and dc operating conditions (dc emitter current and dc collector voltage) were evaluated. The results are compared with results obtained from analysis based on calculations using physical constants of the transistor. The explanation of the behavior of the reverse open-circuit voltage amplification factor, μ_{bc}, of the common

emitter circuit is given in detail. Characteristics of μ_{bc} and properties of h_{22} (the output admittance with input open) are correlated. (auth)

7606

NEW TYPE OF ION-RESONANCE MASS SPECTROMETER WITH OPTIMUM RESOLUTION CAPACITY. (to General Electric Co.). German Patent DAS 1,061,542. July 16, 1959. Atompraxis 5, 502(1959). (In German)

In a high-frequency ion-resonance mass spectrometer, an electric high-frequency field diagonal to the electron beam and a magnetic field perpendicular to the electric field are produced by a condenser plate. Therefore, the ions produced in the ionization chamber are forced to follow a spiral path in the plane of the electric field. For a given electric and magnetic field only ions with a predetermined m/e ratio (so-called resonance ions) were accelerated permanently in a spiral orbit with increasing diameter. At a fixed distance from the middle point of the ionization chamber in the plane of the ion orbit a collection screen is built on which the resonance ions collide. The non-resonance ions oscillate in and out of the fraction to be analyzed, but never obtain an acceleration sufficient to collect on the screen. By variation of the frequency of the electric field at constant magnetic field, ions with varying natural frequencies and with varying m/e ratios could be collected. The amount of ions so collected could serve as measurement of the composition of the gas sample. Therefore all components of a gas sample could be determined by continuous scanning of the mass spectrum. It was established that in a frequency change of the mass spectrometer the resolution capacity, i.e., the capacity of the instrument to separate ions with a given m/e ratio from ions with directly adjacent m/e ratios, decreases at high m/e ratios. It was therefore proposed to vary the amplitude of the high-frequency voltage in inverse ratio to the m/e ratio in order to compensate for the decrease in the resolution capacity. (J.S.R.)

7607

RADIOACTIVE HOLLOW CYLINDER MAKES POSSIBLE SIMPLE STANDARDIZATION MEASUREMENTS OF LIQUID COUNTER TUBES. Martin Wenzel. German Patent DGM 1,774,919. Oct. 2, 1958. Atompraxis 5, 502(1959). (In German)

For the simple performance of standardization and calibration measurements in liquid counter tubes, it was proposed to introduce a sealed radioactive preparation in the form of a hollow cylinder into the measurement space of the counter instead of filling the counters with a radioactive solution. The hollow cylinder can be made from various materials, for example from a metallic plate, on which a radiometal is electrodeposited. By this innovation a decontamination of the counter after each calibration should be unnecessary. (J.S.R.)

7608

PRESSURE TRANSDUCER. H. H. Sander (to U. S. Atomic Energy Commission). U. S. Patent 2,907,897. Oct. 6, 1959.

A pressure or mechanical force transducer particularly adaptable to miniature telemetering systems is described. Basically the device consists of a transistor located within a magnetic field adapted to change in response to mechanical force. The conduction characteristics of the transistor in turn vary proportionally with changes in the magnetic flux across the transistor such that the output (either frequency of amplitude) of the transistor circuit is proportional to mechanical force or pressure.

7609

APPARATUS FOR MEASURING TOTAL NEUTRON CROSS SECTIONS. L. Cranberg (to U. S. Atomic Energy Commission). U. S. Patent 2,908,822. Oct. 13, 1959.

An apparatus is described for measuring high-resolution total neutron cross sections at high counting rate in the range above 50-kev neutron energy. The pulsed-beam time-of-flight technique is used to identify the neutrons of interest which are produced in the target of an electrostatic accelerator. Energy modulation of the accelerator makes it possible to make observations at 100 energy points simultaneously.

7610

PROTON RESONANCE MONITOR. J. G. Bayly (to U. S. Atomic Energy Commission). U. S. Patent 2,911,587. Nov. 3, 1959.

An apparatus is described for monitoring the proton resonance of a liquid which is particularly useful in the continuous purity analysis of heavy water. A hollow shell with parallel sides defines a meander chamber positioned within a uniform magnetic field. The liquid passes through an inlet at the outer edge of the chamber and through a spiral channel to the central region of the chamber where an outlet tube extends into the chamber perpendicular to the magnetic field. The radiofrequency energy for the monitor is coupled to a coil positioned coaxially with the outlet tube at its entrance point within the chamber. The improvement lies in the compact mechanical arrangement of the monitor unit whereby the liquid under analysis is subjected to the same magnetic field in the storage and sensing areas, and the entire unit is shielded from external electrostatic influences.

7611

VARIABLE TIME DELAY MEANS. R. E. Clemensen (to U. S. Atomic Energy Commission). U. S. Patent 2,911,598. Nov. 3, 1959.

An electrically variable time delay line is described which may be readily controlled simultaneously with variable impedance matching means coupled thereto such that reflections are prevented. Broadly, the delay line includes a signal winding about a magnetic core whose permeability is electrically variable. Inasmuch as the inductance of the line varies directly with the permeability, the time delay and characteristic impedance of the line both vary as the square root of the permeability. Consequently, impedance matching means may be varied similarly and simultaneously with the electrically variable permeability to match the line impedance over the entire range of time delay whereby reflections are prevented.

7612

MULTICHANNEL ANALYZER. G. G. Kelley (to U. S. Atomic Energy Commission). U. S. Patent 2,912,577. Nov. 10, 1959.

A multichannel pulse analyzer having several window amplifiers, each amplifier serving one group of channels, with a single fast pulse-lengthener and a single novel interrogation circuit serving all channels is described. A pulse followed too closely timewise by another pulse is disregarded by the interrogation circuit to prevent errors due to pulse pileup. The window amplifiers are connected to the pulse lengthener output, rather than the linear amplifier output, so need not have the fast response characteristic formerly required.

7613

WIDE BAND REGENERATIVE FREQUENCY DIVIDER AND MULTIPLIER. E. F. Laine (to U. S. Atomic Energy Commission). U. S. Patent 2,913,670. Nov. 17, 1959.

A regenerative frequency divider and multiplier having wide band input characteristics is presented. The circuit

produces output oscillations having frequencies related by a fixed ratio to input oscillations over a wide band of frequencies. In accomplishing this end, the divider-multiplier includes a wide band input circuit coupled by mixer means to a wide band output circuit having a pass band related by a fixed ratio to that of the input circuit. A regenerative feedback circuit derives a fixed frequency ratio feedback signal from the output circuit and applies same to the mixer means in proper phase relation to sustain fixed frequency ratio oscillations in the output circuit.

7614

THERMAL COUPLE FOR MEASURING TEMPERATURE IN A REACTOR. W. Kanne (to U. S. Atomic Energy Commission). U. S. Patent 2,914,594. Nov. 24, 1959.

A thermocouple device for measuring the temperature of a flowing fluid in a conduit within which is positioned a metallic rod is presented. A thermocouple junction is secured to the rod centrally, and thermal insulating support disks having a diameter greater than the rod are secured to the end portions of the rod and adapted to fit transversely in the conduit.

7615

TIME CALIBRATED OSCILLOSCOPE SWEEP CIRCUIT. V. L. Smith and H. K. Carstensen (to U. S. Atomic Energy Commission). U. S. Patent 2,914,697. Nov. 24, 1959.

An improved time calibrated sweep circuit is presented, which extends the range of usefulness of conventional oscilloscopes as utilized for time calibrated display applications in accordance with U. S. Patent No. 2,832,002. Principal novelty resides in the provision of a pair of separate signal paths, each of which is phase and amplitude adjustable, to connect a high-frequency calibration oscillator to the output of a sawtooth generator also connected to the respective horizontal deflection plates of an oscilloscope cathode ray tube. The amplitude and phase of the calibration oscillator signals in the two signal paths are adjusted to balance out feedthrough currents capacitively coupled at high frequencies of the calibration oscillator from each horizontal deflection plate to the vertical plates of the cathode ray tube.

7616

PRESSURE SENSING DEVICE. K. E. Pope (to U. S. Atomic Energy Commission). U. S. Patent 2,917,597. Dec. 15, 1959.

This device is primarily useful as a switch which is selectively operable to actuate in response to either absolute or differential predetermined pressures. The device generally comprises a pressure-tight housing divided by a movable impermeable diaphragm into two chambers, a reference pressure chamber and a bulb chamber containing the switching means and otherwise filled with an incompressible non-conducting fluid. The switch means comprises a normally collapsed bulb having an electrically conductive outer surface and a vent tube leading to the housing exterior. The normally collapsed bulb is disposed such that upon its inflation, responsive to air inflow from the vent, two contacts fixed within the bulb chamber are adapted to be electrically shorted by the conducting outer surface of the bulb.

7617

RADIATION DETECTING AND TELEMETERING SYSTEM. H. K. Richards (to U. S. Atomic Energy Commission). U. S. Patent 2,917,633. Dec. 15, 1959.

A system is presented for measuring ionizing radiation at several remote stations and transmitting the measured information by radio to a central station. At each remote station a signal proportioned to the counting rate is applied across an electrical condenser made of ferroelectric material. The voltage across the condenser will vary as a function of the incident radiation and the capacitance of the condenser will vary accordingly. This change in capacitance is used to change the frequency of a crystal-controlled oscillator. The output of the oscillator is coupled to an antenna for transmitting a signal proportional to the incident radiation.

7618

GEIGER-MÜLLER TYPE COUNTER TUBE. I. L. Fowler and L. A. K. Watt (to U. S. Atomic Energy Commission). U. S. Patent 2,917,647. Dec. 15, 1959.

A single counter tube capable of responding to a wide range of intensities is described. The counter tube comprises a tubular cathode and an anode extending centrally of the cathode. The spacing between the outer surface of the anode and the inner surface of the cathode is varied along the length of the tube to provide different counting volumes in adjacent portions of the tube. A large counting volume in one portion adjacent to a low-energy absorption window gives adequate sensitivity for measuring low-intensity radiation, while a smaller volume with close electrode spacing is provided in the counter to make possible measurement of intense gamma radiation fields.

Materials Testing

7619 DMIC-121

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

METHODS FOR CONDUCTING SHORT-TIME TENSILE, CREEP, AND CREEP-RUPTURE TESTS UNDER CONDITIONS OF RAPID HEATING. Donald P. Moon and Ward F. Simmons. Dec. 28, 1959. 40p. Contract AF18(600)-1375. (PB-151078). OTS.

The equipment and testing methods used by 15 different organizations in the tensile and short-time creep testing of materials under conditions of rapid heating are reviewed. Special attention is devoted to specimen design, method of heating, and the measurements of temperature, load, and strain during the test. ASTM-recommended practices are cited, and relative merits of alternative techniques are discussed. (auth)

GEOLOGY, MINERALOGY, AND METEOROLOGY

7620 AD-217696

Massachusetts Inst. of Tech., Cambridge.

APPLICATION OF WEATHER RADAR TO FALLOUT PREDICTION. Quarterly Technical Report No. 4 covering Period December 1, 1958 through February 28, 1959. Pauline M. Austin. Mar. 15, 1959. 14p. DA Project 3-99-04-112. Contract DA-36-039-SC-75030.

In instrumentation work, plans have been made to attach equipment to the AN/CPS-9 radar which will present the data in the form of range-corrected signal intensity contours. Work will begin immediately on the construction of this equipment and the modification required for its installation. Instrumentation and calibration of pairs of Pulse Integrators and R-meters and the four-channel Sanborn recorder are almost complete. We hope to obtain fluctuation measurements simultaneously from two points during the coming quarter. In storm structure analysis consideration is being given to the development of squall

lines and to the study of warm front rain patterns. Representative wind fields for storms associated with cold fronts and warm fronts have been set up. The time distribution of radioactive materials in these wind fields has been computed for certain very simple initial distributions. Extension to the cases where detonations occur at high levels is now under way. (auth)

7621 AD-220224

Massachusetts Inst. of Tech., Cambridge.

APPLICATION OF WEATHER RADAR TO FALLOUT PREDICTION. Quarterly Technical Report No. 5 covering Period March 1, 1959 through May 31, 1959. Pauline M. Austin. June 15, 1959. 15p. DA Project 3-99-04-112. Contract DA-36-039-SC-75030.

Measurements of the transmitted power, beam pattern, and antenna gain for the SCR-615-B and AN/CPS-9 radars have been completed. The values obtained for the SCR-615-B are in excellent agreement with previous calibrations. The measured value of antenna gain for the AN/CPS-9 was somewhat higher than that indicated by other measurements. The major instrumentation work is the construction of a unit for obtaining integrated echo intensity contours on the AN/CPS-9 radar. The logarithmic IF strip and a suitable quartz delay line have been obtained. Progress on the building of the instrument is very good. In analytical work detailed analysis of storm structure is continuing. At the present time emphasis is on warm frontal rain and summertime squall lines. A detailed study of the effect a particular storm might have on the distribution of fall-out from a nuclear detonation is underway. (auth)

7622 HW-61780

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

SUBSURFACE GEOLOGY OF THE HANFORD SEPARATION AREAS. D. J. Brown. Oct. 1, 1959. 20p. Contract AT(45-1)-1350. OTS.

Five geologic units are known beneath the region in which Hanford's chemical processing plants are located. In ascending order these include the Columbia River basalts and the interbeds of the Ellensburg formation in the upper part of the basalt series, the Ringold formation, Palouse soil, and a thick deposit of fluviatile and glaciofluviatile sediments. (W.L.H.)

7623 NP-8311

Canada. Dept. of Mines and Technical Surveys.

A SURVEY OF THE URANIUM INDUSTRY IN CANADA. J. W. Griffith. Nov. 1959. 98p.

Available as Can. Dept. Mines and Tech. Surveys, Mineral Resources Inform. Bull. M.R. 34. $0.50.

Canadian uranium production in 1957 and 1958, ore reserves, world production and reserves, mining and milling methods, costs, refining, uses, prices, and markets are discussed. Also included is a brief outline of thorium in Canada. (W.L.H.)

7624 NRL-Trans-671

THE STUDY OF THE ION RECOMBINATION CONSTANT IN TURBULENT ATMOSPHERE. (Izuchenie Postoyannoi Propadaniya Ionov v Turbulentnoi Atmosfere). V. B. Milin and P. N. Tverskoi. Translated by A. Pingell from Uchenye Zapiski Leningrad. Gosudarst. Univ. im. A. A. Zhdanova, Ser. Fiz. Nauk, No. 9, 72-82(1956). 13p.

A method is presented for determining β (ion recombination constant) in the next-to-the-earth atmospheric layer, taking into account the turbulent mixing occurring in the latter. This method is based on the theoretical scheme establishing the basic principles of distribution of the ion flux under natural conditions as well as under artificially produced ionization. (W.L.H.)

7625

CONDITIONS FOR THE REDUCTION AND PRECIPITATION OF URANIUM BY MINERALS. R. P. Rafalskii and K. F. Kudinova. Atomnaya Energ. 7, 333-7(1959) Oct. (In Russian)

It is postulated that primary uranium minerals were precipitated by iron, sulfur, and arsenic reduction of U(VI) present in hydrothermal solutions. Experiments produced crystalline pitchblende, collomorphic uranium powder, and sooty uranium black formed by reduction of U(VI) to U(IV) by acid solutions at 100 to 135°C. The character of the formation depends upon the precipitator mineral, interaction temperature, and in some cases on the concentration of uranium in solution. (R.V.J.)

7626

A DISCUSSION ON THE RESULTS OF SCREEN ANALYSIS OF THE URANIUM ORE FROM THE NINGYO-TOGE MINE. K. Kanazawa (Atomic Fuel Corp., [Tokyo]). J. Atomic Energy Soc. Japan 1, 385-91(1959). (In Japanese)

The oversize of 300 mm may be rejected as waste from high-grade ore containing 0.1 to 0.2% U_3O_8 and the oversize of 50 mm may be rejected as waste from low-grade ore containing 0.01 to 0.05% U_3O_8. By rejecting wastes containing less than 0.01% U_3O_8, the amount of feed for leaching will be reduced to about half that of run-of-mine ore and the grade of the remaining ore becomes about twice that of the run-of-mine ore. The recovery of uranium may be more than 80%. The uranium minerals which adhere to the surface of lump ores may be recovered by washing. (auth)

7627

AIRBORNE MEASUREMENT OF ATMOSPHERIC CONDUCTIVITY IN FIFTEEN-DAY-OLD THERMONUCLEAR DEBRIS. Robert V. Anderson and G. P. Serbu (Naval Research Lab., Washington, D. C.). J. Geophys. Research 65, 223-6(1960) Jan.

Total atmospheric conductivity was measured on a flight through fifteen-day-old thermonuclear debris. Significant increases in conductivity were noted within the debris at altitudes of 17,000 and 5000 feet. The relative increases at the two altitudes are found to be in good agreement with values calculated from ion-equilibrium conditions. (auth)

7628

ISOTOPIC EVIDENCE ON THE ORIGIN AND AGE OF THE BLIND RIVER URANIUM DEPOSITS. J. A. Mair, A. D. Maynes, J. E. Patchett, and R. D. Russell (Univ. of Toronto). J. Geophys. Research 65, 341-8(1960) Jan.

Isotopic analyses of lead extracted from a variety of minerals from Blind River, Ontario, are reported. The detrital minerals monazite and zircon both give lead-ratio ages of 2500 million years. The uraninite ore gives a lead-ratio age of 1700 m y. Other isotopic evidence is quoted to suggest that the age of the sediment in which the uranium is found may also be approximately 1700 m y, or older. The lead found in pyrite, pyrrhotite, sericite, and feldspar has anomalous isotopic ratios which can be explained by the hypothesis that they received additions of radiogenic lead from the uraninites (presumed to be 1700 m y old) 1200 to 1300 m y ago. In any case the age of these minerals, in the sense of time of last chemical alteration, is not greater than 1450 ± 150 m y. All our measurements can be interpreted without assuming a major period of mineralization more recent than 1000 m y ago, although we are unable to rule out such a possibility from our evidence. (auth)

7629
CALCULATION OF COSMIC-RAY AGES IN THE IRON METEORITES 'CARBO' AND 'TREYSA'. H. Voshage and H. Hintenberger (Max-Planck-Institut für Chemie, Mainz). Nature 185, 88-9(1960) Jan. 9.

The method is discussed for determining the cosmic radiation age of meteorites based on the fact that potassium-41 and potassium-40 are formed at the same time. As the result of isotopic abundance measurements the radiation ages of the iron meteorites Carbo and Treysa were determined. Procedures are described. (C.H.)

7630
ISOTOPIC DISTRIBUTION IN A GREENLAND ICEBERG. W. Dansgaard, G. Nief, and E. Roth (Centre d'Études Nucléaires, Saclay, France). Nature 185, 232(1960) Jan. 23.

Parallelism between the deuterium and oxygen-18 content has been shown in snow samples from the Greenland ice cap. Investigation of a stratigraphical series of snow and ice samples from a borehole 400 m deep showed this parallelism is conserved in the ice during several hundred years. (C.H.)

7631
STRATIGRAPHY AND URANIUM CONTENT OF THE CHATTANOOGA SHALE IN NORTHEASTERN ALABAMA, NORTHWESTERN GEORGIA AND EASTERN TENNESSEE. Lynn Glover. U. S. Geol. Survey Bull. 1087-E. 39p., 5 illus. $1.00(GPO).

In northeastern Alabama, northwestern Georgia, and eastern Tennessee, the Chattanooga shale of Late Devonian age ranges in thickness from 0 to more than 40 feet. Most of the shale is of the Gassaway member, though the Dowelltown member is present in part of eastern Tennessee. Beds of Dowelltown age were found in a small area in Alabama and Georgia, but the member is not recognized there. The Chattanooga shale and the overlying Maury formation, which is chiefly of Mississippian age, are progressively overlapped in the vicinity of Birmingham, Ala. Along the eastern margin of the late Chattanooga sea, which coincided roughly with the region studied, stable shelf conditions prevailed, but the degree of stability was somewhat less than that to the west in the Eastern Highland Rim area. This difference is indicated in the east by the somewhat more silty and sandy sections, intraformational conglomerates, greater range in thickness of the shale, and in a few places by preservation of basal conglomerate. Phosphate nodules and minor amounts of chert were deposited in the east, and the distribution of each is areally and stratigraphically distinct. The chert probably accumulated in quieter water than did the phosphate. Occasional influxes of greater than usual amounts of inorganic material produced the gray beds common in the Chattanooga. These beds have more clay and less organic matter than do the black beds. The Maury formation in Georgia and southeastern Tennessee contains lentils of black shale; and in central-eastern Tennessee where the typical greenish Maury lithology is absent, beds equivalent in age to the Maury are of black and gray shale. Less stable conditions of deposition and wide distribution of phosphatic black shale account for the generally low uranium content (less than 0.005 percent) of the Chattanooga shale in the region studied. (auth)

7632
FURTHER RESEARCH ON U-BEARING SECONDARY MINERALS OF VAL RENDENA. Carlo L. Garavelli and Fiorenzo Mazzi (Comitato Nazionale per le Ricerche Nucleari, Rome). 24p. of "Studi e Ricerche della Divisione Geomineraria. Vol. II. 1959." Rome, Comitato Nazionale Per Le Ricerche Nucleari, 1959. (In Italian).

A study was made of some U-bearing secondary minerals occurring in the lower zones of the U-deposit of Val Rendena in the south-west of Trentino. Particular methods have been employed in order to identify the very small quantities of available materials. Normally, the identification has been accomplished by means of x-ray methods, both diffractometric and spectrographic. The following minerals have been found: bacquerelite, wölsendorfite, epi-ianthinite (or ianthinite), curite and the "mineral A of Frondel" among the hydroxides; kasolite (very widespread) and uranophane among the silicates; renardite, ferroan metazeunerite and metatyuyamunite among the phosphates, arsenates, and vanadates. The paragenetic significance as well as some chemical features of these minerals are emphasized. (auth)

HEALTH AND SAFETY INCLUDING DOSIMETRY

7633 AD-218530
Army Medical Research Unit No. 1, Landstuhl Army Medical Center, Germany.
INITIAL CALIBRATION OF LANDSTUHL HUMAN RADIOACTIVITY DETECTOR (BODY COUNTER). Progress Report. Charles O. Onstead, Frank V. Keary, Jack E. Redding, and John R. Appert. June 30, 1959. 10p.

Calibration of the Landstuhl human radioactivity detector is described. The method proved adequate for measuring the cesium-137 and potassium-40 present within the normal human. (C.H.)

7634 AECU-4680
General Mills, Inc., Minneapolis.
UPPER ATMOSPHERE MONITORING PROGRAM. Progress Report No. 8 [for] May 1, 1959 through July 31, 1959. Report No. 1919. J. Baumstark, S. Jones, S. Stern, L. Torgeson, and W. Zeller. Jan. 15, 1960. 43p. Project No. 89125. Contract AT(11-1)-401. OTS.

Progress is reported in an investigation of the physical parameters involved in the collection of airborne radioactive particles and the development, fabrication, and calibration of balloon-borne sampling equipment to enable the precise determination of stratospheric particle concentration and particle size distribution. Further refinements are reported in calibrating the two-state, rectangular jet impactor and in the design of a focusing array impactor. Results are reported from an exploratory investigation of improved filtration with corona discharge, a theoretical and experimental study of fibrous filters, and the development of homogeneous aerosols less than 20 millimicrons in diameter. The results of three balloon flights during the period are summarized and discussed. Based on flight data and radiochemical analyses for some previous flights, particle sizes are estimated for individual radiochemical species. An analysis of total beta activity since the spring of 1958 indicates a trend toward decreasing activity with time since the last nuclear weapons tests in October 1958. (C.H.)

7635 AERE-R-3067
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
SOME ASPECTS OF FIRES IN GLOVE BOXES. C. Jackson, T. W. Hodge, D. H. Swingler, and A. J. Smith. Oct. 1959. 27p. BIS.

A series of tests was carried out to determine the magnitude of the stresses to which a glove box and its associated fittings would be subject if a fire occurred within the box. From this information an attempt was made to forecast the probable effect of accidental fires. A few fire-extinguishing agents were tested in the light of estimated requirements. (auth)

7636 HASL-50

New York Operations Office. Health and Safety Lab., AEC.
RADIATION SURVEY, COLUMBIA UNIVERSITY VAN DE GRAAFF. Nov. 7, 1958. 16p. OTS.

A radiation survey was performed at the Van de Graaff electrostatic generator at Columbia University. Radiation levels are reported and recommendations regarding radiation safety are made. (auth)

7637 HW-61247

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES. Quarterly Progress Report [for] April–June 1959. July 20, 1959. 42p. Contract AT(45-1)-1350. OTS.

Progress is reported in the following studies: the toxicity of chronically ingested strontium-90, radium-226, and plutonium-239 in miniature swine; the effects of temperature and radiation on the incidence of bacterial infection from C. columnaris among fish in the Columbia River; atmospheric diffusion in stable conditions; standardization of circuits for use in various types of radiation survey instruments; the determination of the chemical form of isotopes present in reactor effluent water; the use of aluminum turnings to remove isotopes from the effluent water; geology and soil physics of the Hanford plant area; and the deposition of air-borne particles of plutonium from production plant exhaust air. (For preceding period see HW-60137.) (C.H.)

7638 HW-61676

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
HANFORD ENVIRONMENTAL MONITORING ANNUAL REPORT, 1958. B. V. Andersen. Aug. 27, 1959. 18p. Contract AT(45-1)-1350. OTS.

The Hanford plant releases small amounts of radioactive materials to the atmosphere and the Columbia River. These materials are a potential source of radiation exposure to the people in the environs, and the radiation exposure to the general population residing near Hanford has been measured and evaluated routinely since the establishment of the plant in 1944. Data are presented for 1958. The actual concentration of radioactive materials found in the environs is small enough that the radiation exposure from Hanford sources cannot be accurately separated from that due to natural background and nuclear bomb debris. Estimates of Hanfords' contribution to radiation exposure in the environs are made and summaries are included of the release rates from various waste sources. (C.H.)

7639 NP-8193

Pittsburgh Coke and Chemical Co. Research and Development Dept.
A NON-SELECTIVE COLLECTOR FOR SAMPLING GASEOUS AIR POLLUTANTS. Final Report for the Six Quarters Ending December 15, 1958. Stanton B. Smith and Richard J. Grant. 1959. 68p. Contract SAPH-68345.

Issued as Robert A. Taft Sanitary Engineering Center report A59-3.

The problem of collecting field samples of gaseous atmospheric contaminants has been investigated and a prototype collector design proposed which consists of two activated carbon columns in series, the second of which is refrigerated in dry ice. A field collector kit containing all accessory equipment for collecting 100-liter samples was designed and built. Tests conducted on a specially constructed flow apparatus indicated the complete collection of methane and less volatile substances at concentrations of about 150 ppm. Strong oxidants cannot be handled since these react with the adsorbent. Good recovery of the adsorbed materials for analysis was achieved. However, further investigation of desorption and analytical techniques is required. (auth)

7640 NP-8202

Sweden. Försvarets Forskningsanstalt, Stockholm.
THE FISSION PRODUCTS Zr 95 AND Nb 95 IN SWEDISH SOILS. K. Löw and I. Ö. Andersson. Sept. 1959. 11p.

The deposit of the fission products $(Zr + Nb)^{95}$ in Swedish soils was determined by γ-spectrometric measurements of soil samples taken during the latter half of 1958. The mean values for different regions vary between 85 and 180 mc km^{-2}. The standard deviation within each group is 30 to 40%. (auth)

7641 NP-8203

Sweden. Försvarets Forskningsanstalt, Stockholm.
GAMMA RADIOACTIVITY OF SWEDISH PEOPLE MEASURED DURING MAY AND JUNE 1959. Ingvar Andersson. Sept. 1959. 23p.

A spectrometer for humans consisting of a 4-inch-diameter × 4-inch-thick Na(Tl)I crystal, a 23-ton iron shield, and a 70-channel pulse-height analyzer was built. The calibration was carried out by phantom measurements and by K^{42} injections in man. A group of 19 females and 27 males of age about twenty was measured. The mean value of the cesium/potassium ratio was in males 73 $\mu\mu$c Cs/g K and in females 57 $\mu\mu$c Cs/g K. The standard deviation was in both cases 28%. The mean value of potassium/body weight ratio was in males 2.20 g K/kg and in females 2.18 g K/kg. The standard deviation was 13%. (auth)

7642 NP-8322

Bureau of Mines. Div. of Explosives Technology, Pittsburgh.
RESEARCH ON THE HAZARDS ASSOCIATED WITH THE LARGE SCALE PRODUCTION AND HANDLING OF LIQUID HYDROGEN. Annual Report for January 1–December 31, 1958. (Report No. 3745). Michael G. Zabetakis and David Burgess. 56p. Project No. 8(12-3048).

An investigation was initiated to determine the hazards involved in the production and handling of hydrogen. Three types of experiments were conducted to evaluate the hazards of accidental spillage of liquid hydrogen. Hydrogen–air mixtures above glass and stainless steel dewars containing liquid hydrogen were ignited. Liquid hydrogen (0.5 to 7.4 l) was spilled from an open-mouth dewar and gas samples were collected at various times and heights up to 13 ft above ground level to determine the duration and extent of the flammable mixtures formed. Spills of liquid hydrogen (0.2 to 8.0 l) were ignited at ground or dewar level or at 5 ft above ground level to determine the size of resultant fireball, radiant energy (horizontal plane near ground), and blast pressure produced. The mode of burning and burning rate of liquid hydrogen above an open container as a function of time, container diameter, conduction region (small burner diameters), and transition region (intermediate burner diameters) were investigated and compared to the burning mode of methanol, benzene, and butane. The results of studies on the radiation of gaseous

diffusion and liquid fuel flames of various fuels are reported as percentage of thermal output radiated. Tests in unconfined spaces indicate that two potential hazards arise from ignition of the flammable mixtures above liquid hydrogen: direct exposure to the fireball formed and exposure to the radiant energy liberated. Equations are presented for calculating the fireball radius and radiant energy radius in terms of pounds of liquid hydrogen. (C.J.G.)

7643 NP-8323

Bureau of Mines. Div. of Explosives Technology, Pittsburgh.

RESEARCH ON THE HAZARDS ASSOCIATED WITH THE LARGE SCALE PRODUCTION AND HANDLING OF LIQUID HYDROGEN. Quarterly Progress Report [for] January 1–March 31, 1959. David Burgess and Michael G. Zabetakis. 20p. Project No. 8(22-3151).

The effects of spilling liquid hydrogen on a macadam surface (7.4 l) at 39°F and on a gravel surface (7.7 l) at 66°F were investigated relative to size of visible cloud formed and rate of cloud expansion and rise. The cloud size, the rate of increase in size, and rate of rise was greater for the gravel surface. The results are given of an experiment in which liquid hydrogen (7.8 l) was spilled on a gravel surface at 65°F and ignited 20 in. above the spill area. Portions of the cloud were observed to detach from the main flame. A burning rate of 0.9 cm/min was experimentally determined for a 6-in. diameter dewar filled to an 11-in. depth with liquid hydrogen, which corresponded to a total heat input rate to the liquid of 86 watts. From experiments on burning and vaporization rates, it was concluded that the measured burning rate was determined primarily by heat leakage that was independent of the presence of the flame. A differential thermocouple was devised for determining the amount of flame radiation falling on the surface of a burning liquid fuel. Measurements of the radiation of methanol flames were conducted with the probe at various positions in glass and metal containers. (For preceding period see NP-8322.) (C.J.G.)

7644 NP-8324

Bureau of Mines. Div. of Explosives Technology, Pittsburgh.

RESEARCH ON THE HAZARDS ASSOCIATED WITH THE LARGE SCALE PRODUCTION AND HANDLING OF LIQUID HYDROGEN. Quarterly Progress Report [for] April 1–June 30, 1959. Michael G. Zabetakis and David Burgess. 12p. Project No. 8(22-3151).

The effects of liquid hydrogen (1.4 to 16.2 l) spillage on gravel and steel plate were studied relative to blast pressure upon ignition (less than 1 to 20 sec following spillage), flame volume, and radiant energy. The radiant energy and flame volume decreased with increased time between spillage and ignition time. The blast pressure increased at first, then decreased with increasing ignition time. Under optimum conditions it was found that the flame volume can exceed the lower limit mixture volume (i.e., 25 times the hydrogen gas volume). Initial flame propagation rates were erratic. From curves of surface regression rate vs. vessel diameter for hydrogen, butane, benzene, hexane, methanol, and aviation gasoline, the burning rates appeared to level off for most of the fuels. The liquid hydrogen burning curve did not level off (experiments were only performed on three vessels of 33.0, 15.0, and 7.0 cm diameter). Cross drafts had little effect on the burning rates of methanol and hexane but increased the flame temperature of benzene. Updraft decreased the burning rate of methanol but increased the rate of hexane. (For preceding period see NP-8323.) (C.J.G.)

7645 NP-8325

Bureau of Mines. Div. of Explosives Technology, Pittsburgh.

RESEARCH ON THE HAZARDS ASSOCIATED WITH THE LARGE SCALE PRODUCTION AND HANDLING OF LIQUID HYDROGEN. Quarterly Progress Report for July 1–September 30, 1959. David Burgess and Michael G. Zabetakis. 13p. Project No. 8(22-3151).

The effects of liquid hydrogen (24 to 90 l) spillage on gravel and steel plate were studied relative to blast pressure upon ignition (1.3 to 15.8 sec) at 18 in. and 10 ft above spill area, radiation energy, flame cross section and volume, and overpressure. The overpressure was determined as functions of time (0 to 16 sec) and distance (20 to 200 ft) for the hydrogen–air mixtures ignition above pools of liquid hydrogen (15.4 to 90 l). The absorption of flame radiations by fuel vapors through flame heights of 0 to 15 in. was determined for hydrogen, benzene, hexane, and methanol. The absorption of flame radiations on the hydrogen surface was found to be unaffected by flame height. In trays of sufficient diameter, it is concluded that the liquid burning rate is inversely proportional to the fraction of the flame's heat that must be fed back to maintain evaporation. Although the burning rate plateau has not been located for hydrogen, the best estimate of the burning rate is 1.6 to 2.0 cm/min. Tests were performed to determine the initial burning stages of hydrogen: film boiling, nucleate boiling, and a quiet stage during which heat transfer is limited by the thermal diffusivity of the subsurface. Liquid nitrogen was spilled into dewar flasks, one containing close-fitting paraffin blocks and the other brass blocks. In the case of the brass, gas evolution never exceeded the nucleate boiling stage, the gas evolution rate being independent of time until the liquid had almost disappeared. On spilling into paraffin, the final evaporation stage was observed for 30 sec. (For preceding period see NP-8324.) (C.J.G.)

7646 USNRDL-TR-385

Naval Radiological Defense Lab., San Francisco.

FRACTIONATION. I. HIGH-YIELD SURFACE BURST CORRELATION. E. C. Freiling. Oct. 29, 1959. 40p.

The phenomenon of fractionation is described, and its importance to various radiological and nuclear chemical problems is explained. Fractionation data from four high-yield surface bursts over sea water and coral are then correlated. The correlations appear to hold within a factor of 2 for even the worst cases, compared to observed fractionation factors as high as 100. Possible applications are discussed. (auth)

7647 WT-617(Del.)

Chemical and Radiological Labs., Army Chemical Center, Md.

FALL-OUT AND CLOUD-PARTICLE STUDIES. June 1953. Decl. with deletions Sept. 15, 1959. 93p. Project 5.4b [of] OPERATION IVY. OTS.

Operation Ivy provided an opportunity to determine fallout characteristics from a thermonuclear device. Instruments and analytical methods are described. Analytical results are tabulated. A physical description of the particles and results of activity measurements are included. Results are included from an aerial survey of ground contamination. Cloud-sampling techniques using snap samplers are described. (C.H.)

7648 WT-915(Del.)

Naval Radiological Defense Lab., San Francisco.

DISTRIBUTION AND INTENSITY OF FALLOUT. R. L. Steton, E. A. Schuert, W. W. Perkins, T. H. Shirasawa, and H. K. Chan. Jan. 1956. Decl. with deletions Sept. 15,

1959. 94p. Project 2.5a [of] OPERATION CASTLE. OTS.

Data are summarized on the distribution and intensity of fall-out from Operation Castle. The data were collected at land stations, anchored lagoon stations, and free-floating sea stations located throughout the Eniwetok Proving Grounds. Characteristics of fall-out, gamma dose, and rate of arrival are discussed. (C.H.)

7649 WT-1017

Naval Radiological Defense Lab., San Francisco.
FALL-OUT AND AIRBORNE ACTIVITY IN OPERATION WIGWAM, WITH NOTES ON SURFACE EFFECTS. Frederic A. French. May 1955. 27p. Project 2.7 [of] OPERATION WIGWAM. OTS.

Superseded ITR-1087.

The objectives of this project were to evaluate the fall-out from a deep underwater nuclear detonation, to provide a dye marker at surface zero, and to measure the radiation dosage at surface zero. The locations and means available for obtaining direct information relevant to fall-out were very limited; consequently, very little information was obtained. The best available information is that obtained by the photographic missions. (auth)

7650 CEA-tr-A-637

PROBLÈMES DE SÉCURITÉ ET DE PROTECTION RELATIFS AUX PROJETS DE RÉACTEURS ET À L'EMPLOI DES RADIOISOTOPES. (Safety and Protection in Reactor Projects and the Use of Radioisotopes). E. Heinz Graul. Translated into French from Atompraxis 3, 468-76(1957). 31p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 5178.

7651

THE NEW RULES FOR TRANSPORTING RADIOACTIVE MATERIALS. A. Shtan and N. Leshchinskiĭ. Atomnaya Energ. 7, 399(1959) Oct. (In Russian)

The new regulations and instructions of the USSR Atomic Energy Administration for handling and transporting radioactive materials are described. (R.V.J.)

7652

RADIATION PROTECTION PROBLEMS IN WORKING WITH RADIOACTIVE ISOTOPES. II. THE DANGER FROM INCORPORATION OF RADIOACTIVE ISOTOPES. Ernst Spode (Deutschen Akademie der Wissenschaften, Berlin). Chem. Tech. (Berlin) 11, 603-6(1959) Nov. (In German)

Special problems arising in incorporation of radioisotopes in the body are discussed. After a treatment of incorporation and distribution in organisms, a classification of the radioisotopes according to their radiotoxicity is presented. A tabulation of radioisotope tolerance values is given which cites critical organ, effective half time ($T_{biol} \times T_{phys} / T_{biol} + T_{phys}$), and maximum permissible concentration in the body, in drinking water, and in the air for over 100 items. Some remarks on contamination of work clothes and body surfaces are included. (T.R.H.)

7653

SAFETY IN RADIOACTIVE MINES. Agustín Martínez (Junta de Energia Nuclear, Madrid). Energia nuclear (Madrid) 3, No. 12, 53-64(1959) Oct.-Dec. (In Spanish)

Radiation and its effects are discussed generally prior to consideration of its effects in mining of radioactive materials. The presentation includes information on the relative danger of various materials, permissible limits for exposure of workers, and protective measures used in various parts of the world. Some ventilation and activity calculations are shown. (T.R.H.)

7654

MEDICAL ASPECTS OF AMBIENT RADIATIONS OF EXTRATERRESTRIAL SPACE. Paul A. Campbell (School of Aviation Medicine, Randolph AFB, Tex.). J. Am. Med. Assoc. 172, 668-71(1960) Feb. 13.

Three types of radiation from which man will have to be shielded during space flights include primary cosmic radiation, secondary cosmic radiation, and the two Van Allen bands of high-speed particles circulating about the earth's geomagnetic equator. At about 400 miles above the earth radiation of the Van Allen type reaches intensities of 10 to 100 r per hour, which would be fatal within 30 days to more than half of a number of human subjects exposed to it for two days. An important problem in space travel is that of circumnavigating the two zones of Van Allen radiation or of devising shields within allowable weight limits. (C.H.)

7655

RADIATION PROTECTION IN REACTORS AND IN NUCLEAR OPERATIONS. [PART] I. M. Oberhofer and P. Kienle (Technische Hochschule, Munich). Kerntechnik 1, 42-9(1959) Aug. (In German)

A survey is presented for the nuclear engineer of the radiation protection practices currently in use. In the first part of the article the origin of various radiations and the physical processes occurring in their passage through tissue are described. The incorporation of radioactive materials and radiological units and quantities are discussed. (J.S.R.)

7656

RADIATION PROTECTION IN REACTORS AND IN NUCLEAR OPERATIONS. [PART] II. M. Oberhofer and P. Kienle (Technische Hochschule, Munich). Kerntechnik 1, 88-93(1959) Sept. (In German)

The natural radiation burden of man and the highest permissible dose are discussed. (tr-auth)

7657

RADIATION PROTECTION IN REACTORS AND IN NUCLEAR OPERATIONS. [PART] III. M. Oberhofer and P. Kienle (Technische Hochschule, Munich). Kerntechnik 1, 127-9(1959) Oct. (In German)

The damaging effects of nuclear radiations and the clinical picture of radiation injury are introduced in this section of the article. 26 references. (tr-auth)

7658

TRITIUM AND DEUTERIUM CONTENT OF ATMOSPHERIC HYDROGEN. Friedrich Begemann (Max-Planck-Institut für Chemie, Mainz) and Irving Friedman (U. S. Geological Survey, Washington, D. C.). Z. Naturforsch. 14a, 1024-31 (1959) Dec. (In English)

The tritium and deuterium content of 24 samples of atmospheric hydrogen collected at ground level near Buffalo, N. Y. (U.S.A.), Hamburg (Germany), and Nürnberg (Germany) during 1954 to 1956 was measured. At the beginning of 1954 the T/H-ratio was found to be 9.18×10^{-14}, i.e., about a factor of 10 higher than 1949 (Faltings and Harteck) and 1951 (v. Grosse et al.), probably due to the first explosion of a thermonuclear device in November 1952. In spite of a major test series of thermonuclear weapons in spring of 1954 (Operation Castle) no further increase in the tritium content was found during 1954 and 1955. It shows instead a seasonal variation with low tritium content in summer and about a threefold higher one in winter. Simultaneously, there is a good correlation between the tritium and deuterium concentrations. From 1956 on a noticeable increase in the tritium content due to more man-made HT produced or released by thermonuclear devices into the atmosphere was found, in agreement

with measurements by Gonsior. A possible explanation of the experimental results as well as a mode to test the validity of the model suggested is given. The deuterium concentrations of the samples analyzed vary between about +7% and –17%, compared to Standard Lake Michigan Water with a ratio D/H = 0.0148 ± 0.0002 mol %. Although from these results only a correlation factor between the tritium and deuterium content of "mean atmospheric hydrogen" and not their absolute values can be derived, it is obvious that atmospheric hydrogen and the water vapor of the atmosphere are not in thermodynamic equilibrium, as has been pointed out before by Harteck and Suess. (auth)

7659

RADIOAKTIVE PARTIKEL. (Radioactive Particles). No. 12 of "Schriftenreihe des Bundesministers for Atomkernenergie und Wasserwirtschaft. Strahlenschutz." Brunswick, Gersbach and Sohn Verlag GmbH. 204p. DM 5.

About 20 papers are presented on radioactive particles from the atmosphere. Origin, behavior, movement, structure, size, activity, statistics, measurement techniques, and biological effects are treated. (T.R.H.)

ISOTOPE SEPARTION

7660 A-42

Virginia. Univ., Charlottesville.

SEPARATION OF THE ISOTOPES OF URANIUM. J. W. Beams. Feb. 5, 1941. Decl. Feb. 1, 1960. 37p. OTS.

Work on centrifuging uranium isotopes is summarized, and methods of spinning long tubes of small diameter are discussed. Centrifuge and rotor designs are given. (W.D.M.)

7661 A-51

Naval Research Lab., Washington, D. C. and Columbia Univ., New York.

THERMAL PHENOMENA IN CENTRIFUGATION. C. Skarstrom and Karl Cohen. [nd]. Decl. Feb. 1, 1960. 10p. OTS.

It is shown that the temperature gradients caused by the heating of an angularly accelerated gas due to compression and the converse cooling of the decelerated gas have appreciable effects on isotope separation factors as determined by centrifugation. These effects were found to be greater than would be indicated by the isothermal theory. The influence of these non-uniform temperatures on the performance of flow-through centrifuges is discussed. (C.J.G.)

7662 A-54

Columbia Univ., New York.

CONCENTRATION OF ISOTOPES BY FRACTIONAL DISTILLATION IN AN ULTRA-CENTRIFUGE. Karl Cohen. [1941?]. Decl. Feb. 1, 1960. 43p. OTS.

The process of fractional distillation in a long ultracentrifuge is examined theoretically for its suitability as a means of concentrating U^{235}. The fractionation and transport of such instruments are found, and tables are constructed from which these properties may be predicted. Numerical examples are given showing that the daily production of a column 10 feet long and 1 inch in diameter, spinning at 3000 rps, is 60 mg of U^{235} at 4 times normal abundance, or 30 mg at 15 times normal abundance. It is found that, within certain limits, narrow columns are better than wide columns. (auth)

7663 A-101

Columbia Univ., New York. [Substitute Alloy Materials Lab.].

ABSOLUTE EFFICIENCIES OF ISOTOPE SEPARATION BY COUNTER-CURRENT CENTRIFUGES. A New Counter-Current Centrifuge. Karl Cohen and Irving Kaplan. Jan. 28, 1942. Decl. Feb. 1, 1960. 37p. OTS.

The theory, the numerical estimates, and the advantages of countercurrent centrifuges are presented. It was found that the fractional distilling centrifuge has an efficiency of 64%, which can be increased by appropriate baffles to 93%. A basic all-gas countercurrent centrifuge is described which appears to have more chance of success. Its top efficiency is 81%. Complete and detailed numerical analyses of cascades of countercurrent centrifuges are given. A brief comparison between flow-through and countercurrent machines is made, and the advantages of the latter are shown. (W.D.M.)

7664 A-260

Virginia. Univ., Charlottesville.

CONCENTRATION OF THE ISOTOPES BY CENTRIFUGING PART I. FLOW THROUGH METHOD. PART II. COUNTER FLOW METHOD. [Aug. 3, 1942?]. Decl. Feb. 1, 1960. 30p. OTS.

The separation of $CO_2 - H_2$ mixtures by centrifuging was investigated. Details of the countercurrent and co-current flow methods are included. (C.W.H.)

7665 A-1784

Virginia. Univ., Charlottesville.

REPORT ON THE APPLICATION OF THE COUNTER CURRENT REFLUXING CENTRIFUGE METHOD TO THE SEPARATION OF THE URANIUM ISOTOPES. J. W. Beams. Mar. 31, 1944. Decl. Feb. 1, 1960. 52p. OTS.

Operational data are given for a centrifuge tube used as a counter-flow refluxing stripper for concentrating U isotopes. The centrifuge and equipment are described in detail. (T.R.H.)

7666 A-1911

Westinghouse Electric and Mfg. Co., East Pittsburgh, Penna.

LONG BOWL GAS SEPARATOR (OEMsr-415). F. C. Rushing. Apr. 6, 1944. Decl. Feb. 1, 1960. 29p. Contract OEMsr-415. OTS.

The project called for development of the mechanics of a gas separator having a bowl 132 inches over-all length by 7.20 inches inside diameter with a rotating speed of 470 rps. Extruded 14ST aluminum alloy was selected for the bowl material. Special design consideration was given to the possible bowl vibration and the necessary damping to limit it. A full scale model was designed and built. After a few trials the bowl was rotated at 385 rps, above all its critical speeds; but on the way down at approximately 300 rps, excessive vibration occurred and the bowl, shafts, and part of the dampers were wrecked. From previous understanding of the design and from subsequent studies, it is believed that the vibration difficulty can be overcome and that this type of machine can be made to operate over the speed range up to 470 rps. As to the long-time operation of a quantity of the machines, the mechanical problems do not appear to be unsurmountable. (auth)

7667 A-3113

Westinghouse Electric and Mfg. Co., East Pittsburgh, Penna.

SHORT BOWL GAS SEPARATOR. F. C. Rushing. Oct. 16, 1944. Decl. Feb. 1, 1960. 33p. Contract OEMsr 489. (SR-239). OTS.

The design and operation of a gas separator having a 36-in. working length and 7.2-in. diameter bowl and a maximum speed of 470 rps are given. (D.E.B.)

7668 NYO-7347
Kidde (Walter) Nuclear Labs., Inc., Garden City, N. Y.
DESIGN AND COST ESTIMATE FOR A FLEXIBLE PLANT WITH TEN LONG-BOWL GAS-CENTRIFUGES. James J. Barker. May 18, 1956. Decl. Feb. 1, 1960. 40p. Contract AT(30-1)-1374, Task VI. OTS.

The detailed description of a pilot plant for the centrifuge process of isotope separation is given. Included are a construction cost estimate, plant specifications, and plant performance with different gases. (T.R.H.)

7669 AEC-tr-3925
STUDIES ON GASEOUS DIFFUSION PLANTS FOR THE ENRICHMENT OF U^{235}. (Studi Sugli Impianti a Diffusione Gasosa per L'Arricchimento Dell'U^{235}.) G. Perona. Translated for Oak Ridge Gaseous Diffusion Plant from Report CISE-66. Apr. 1959. 69p. JCL.

This report has previously been abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 15175.

7670
GERMAN PROCESSES FOR URANIUM ISOTOPE ENRICHMENT. W. Groth (Universität, Bonn). Chem Ing. Tech. 31, 310-18(1959) May. (In German)

The gas-diffusion and jet separation processes and the gas centrifuge treatment are described and their economic prospects are compared. For gas centrifuging theoretical and technical details and experimental results with the isotopes of xenon and argon are reported. (auth)

7671
SWEDISH HEAVY WATER PROCESS. B. J. Eriksson (Allmänna Svenska Elektriska A.B., Västerås, Sweden). Chem. & Process Eng. 41, 5-7(1960) Jan. (In English)

A process for producing heavy water by the dual-temperature isotope exchange between hydrogen sulfide and water is described. Technical and safety problems involved in the process are discussed. The corrosive effects of hydrogen sulfide on various components of the pilot plant are described. (C.J.G.)

7672
ION PAIRS. I. ISOTOPE EFFECTS SHOWN BY CHLORIDE SOLUTIONS IN GLACIAL ACETIC ACID. Reed A. Howald (Harvard Univ., Cambridge, Mass.). J. Am. Chem. Soc. 82, 20-24(1960) Jan. 5.

Appreciable isotopic separation was obtained in countercurrent columns using the distribution of chlorine between HCl gas and solutions of inorganic chlorides in glacial acetic acid. The isotope effects vs. Cl atoms, calculated from the observed enrichments for various species present in the solutions are: HCl (dissolved), 1,0050 ± 0.0002; $HgCl_2$, 1.0061 ± 0.0009; $HCl \cdot H_2O$, 1,0039 ± 0.0003; $SrCl_2$, 1.0042 ± 0.0003; LiCl, 1.0040 ± 0.0003. These results are consistent with a picture involving strong Hg—Cl bonds, but much "looser" interaction between the metal and chlorine atoms in the ion pairs from LiCl and $SrCl_2$. (auth)

7673
THEORY OF ORTHO-PARA HYDROGEN SEPARATION BY ADSORPTION AT LOW TEMPERATURES, ISOTOPE SEPARATION. David White and Edwin N. Lassettre (Ohio State Univ., Columbus). J. Chem. Phys. 32, 72-84(1960) Jan.

A theory of separation of ortho and para hydrogen, by adsorption at low temperatures, is developed by considering the energy levels of a three-dimensional hindered rotator. The Schroedinger equation and boundary conditions are identical with those for prolate spheroidal wave functions and tables of the latter were employed in calculating the energies as functions of the barrier height. Separation factors, at low surface coverage, were computed as a function of barrier height and these pass continuously from unity at zero barrier height over into the limiting separation factor for a two-dimensional rotator (in the adsorbed state) which was used by Sandler in the approximate calculation of separation factors. The theory predicts that ortho hydrogen is more strongly adsorbed than para hydrogen at all barrier heights and that para deuterium is more strongly adsorbed than ortho deuterium. Moreover, the ortho-para hydrogen separation factor is larger at all barrier heights than the para-ortho separation factor for deuterium. These results agree with the experiments of Cunningham, Chapin, and Johnston. Calculated and observed separation factors for hydrogen and deuterium (at low surface coverages) are not in accurate quantitative agreement. This may be due to the fact that experimental separation factors for both isotopes were not determined under comparable conditions. Calculations were made first by assuming that rotation and (center of mass) vibration are separable. This model is then refined to take into account the interaction of rotation and vibration. The separation of the hydrogen-deuterium isotopes is considered. Although the inclusion of interaction between vibration and rotation does not greatly change the ortho-para separation factors, this effect has a marked influence on the calculated isotope separation factors. It is of considerable interest that isotope separation factors are strongly dependent on the ortho-para composition of the isotope mixture, at least at low surface coverages, in the theory developed here. (auth)

7674
ROLE OF THERMAL DIFFUSION IN THE ELECTROLYTIC SEPARATION OF ISOTOPES IN LIQUID METALS. Paul C. Mangelsdorf, Jr. (Univ. of Chicago). J. Chem. Phys. 32, 293-5(1960) Jan.

From the principles of irreversible thermodynamics and the known properties of metals it is inferred that there is a contribution to the Haeffner effect isotope separations arising from the isothermal heat flux accompanying the current flow. The magnitude of this contribution is estimated to be a significant fraction of the observed effect, but of opposite sign. (auth)

7675
SOME PROBLEMS STATED BY THE PUMPING OF AN EXPERIMENTAL CHAIN OF ISOTOPE SEPARATION BY GASEOUS DIFFUSION. R. Doré. Vide 14, 183-96(1959) July-Aug. (In French and English)

The performance of a pilot plant for isotope separation by gaseous diffusion is discussed relative to the vacuum apparatus and techniques employed for combating desorption and corrosion. (C.J.G.)

MATHEMATICS AND COMPUTERS

7676 AECU-4615
Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. MATHEMATICAL METHODS. PART III. ILLIAC USE AND OPERATION. PART IV. IBM 650 USE AND OPERATION. PART V. GENERAL LABORATORY INFORMATION. Sept. 1959. 23p. Contracts AT(11-1)-415 and Nonr-1834(15). OTS.

Progress on the high-speed computer program is indicated and work on mathematical methods is discussed. Use and operation of the ILLIAC and IBM-650 are summarized. (For preceding period see AECU-4532.) (W.D.M.)

7677 BNL-575

Brookhaven National Lab., Upton, N. Y. and California. Univ., Berkeley.

APPLICATIONS OF DISTRIBUTIONS. B. Friedman. June 1959. 14p. OTS.

These notes are based on a series of three lectures given at BNL, which were intended to provide a brief introduction to the theory and applications of distributions. An attempt is made to provide a rigorous basis for the use of the Dirac delta function. The approach is that of Schwartz' but the topology is simplified. The concept of the derivative of a symbolic function is introduced and the problem of integration is considered. Those symbolic derivatives which lead to the concept of finite-part or principal-value integrals are discussed. (W.D.M.)

7678 UCRL-5682

California. Univ., Livermore. Lawrence Radiation Lab.

9-ZOOM—A ONE-DIMENSIONAL, MULTIGROUP, NEUTRON DIFFUSION THEORY REACTOR CODE FOR THE IBM 709. PART I. THEORY AND EQUATIONS. PART II. INPUT AND OPERATING INSTRUCTIONS. PART III. TEST PROBLEM. S. P. Stone, E. T. Collins, and S. R. Lenihan. Aug. 25, 1959. 55p. Contract W-7405-eng-48. OTS.

The UCRL IBM-704 Code, ZOOM, was programmed for the IBM-709. A number of changes was made in input format, power convergence scheme, technique of inner iteration, etc. 9-ZOOM is a memory-contained program requiring no working tapes and is between five and ten times as fast as 704 ZOOM. 9-ZOOM takes advantage of 709 features such as preferential order of multiply by zero, and for small problems approaches input-output limitations with excellent convergence properties. Features of 9-ZOOM are detailed. Theory and equations, input and operating instructions, and a test problem are given. (W.D.M.)

7679 JPRS-2137-N

ON THE ALGORITHM FOR STATISTICAL SELECTION OF HIGH-PROBABILITY SYMBOLS IN SELF-ADJUSTING SYSTEM WITH LIMITED MEMORY. V. L. Epshteyn. Translated from Radiotekh. i Elektron., No. 9, 1563-5 (1959). 5p. OTS.

7680 NP-tr-340

INFORMATION PROCESSING MACHINES. Translated from "Stroje Nazpracovani Informaci," Vol. III, Czechoslovakian Academy of Sciences, Prague, 1955. 481p. OTS.

Sixteen papers are included in this volume. These papers cover the following subjects: Computation of crystal structures, problems of communication equipment and mathematical computers, machine for Fourier's synthesis, testing of memory of Czechoslovak Computer SAPO, computer for solution of algebraic equations, solution of a determined problem of meteorology by means of punch card processing machines, determination of complex roots of algebraic equations on a computer, solutions of linear algebraic equations, interpolation of cot α in the neighborhood $\alpha = 0$, number system of the remainder classes, operational circuits, single-cycle dyadic relay adders, mathematical machines for crystal structures, stabilized-output electronic generator, and Czechoslovakian network analyzers of electric networks. (W.L.H.)

METALS, CERAMICS, AND MATERIALS

General and Miscellaneous

7681 AD-220141

Carborundum Co., Niagara Falls, N. Y.

DEVELOPMENT OF ULTRA REFRACTORY MATERIALS. Progress Report No. 18 [for] May 1 through July 31, 1959. Peter T. B. Shaffer. Aug. 3, 1959. 9p. Contract NOrd-17175.

A furnace in which moduli of rupture can be measured at temperatures near 3630°F in an inert atmosphere was designed and constructed. A dilatometer for measuring thermal expansion coefficients in protective atmospheres was assembled. The physical properties and oxidation resistance of ZrB_2–$MoSi_2$ are being determined. In an attempt to increase melting temperature of the ZrB_2–$MoSi_2$ bodies, varying amounts of $TaSi_2$ were incorporated as a solid solution with $MoSi_2$. (W.L.H.)

7682 AERE-M/M-90

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

INTERIM NOTE ON THE GRAIN REFINEMENT OF URANIUM ALLOYS BY ISOTHERMAL TREATMENT OF THE BETA PHASE. D. C. Minty and B. W. Mott. Feb. 1, 1955. 6p.

The optimum temperatures for the isothermal heat treatment of a number of binary U alloys containing Fe, Cr, Al, and Mo are reported, together with the average grain diameters obtained. Notes are included on the effects of various heat treatments which indicate that the transformation temperature for a given alloy may depend on both the impurity content and the size of specimen. (auth)

7683 APL-JHU-TG-333-1

Johns Hopkins Univ., Silver Spring, Md. Applied Physics Lab.

A SURVEY OF THE BASIC SCIENTIFIC PROBLEMS ASSOCIATED WITH THE BEHAVIOR OF MATERIALS AT HIGH TEMPERATURES. June 1959. 182p. Contract NOrd-7386.

A survey of aspects of materials behavior at high temperatures is presented. Areas examined include high-temperature chemistry and gas dynamics, fluid dynamics of boundary layers, radiation, condensation, gas and liquid film cooling, ablation, insulation, external cooling, erosion and deposition of solids, instrumentation, propellant chemistry, and thermodynamics. An effort was made to sift out the most important points and establish lines along which research should be conducted. (J.R.D.)

7684 ARF-2175-3

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

AN INVESTIGATION OF METAL–CERAMIC COMPOSITES FOR HIGH-TEMPERATURE APPLICATIONS. [Progress Report for] June 1, 1959 to June 30, 1959. Sherwood W. McGee. July 13, 1959. 15p. Contract DA-11-022-505-ORD-3038. (AD-219531).

An experimental program is described in which metal-ceramic bond strength developed during hot pressing at temperatures which produce plasticity in both materials is being studied. Induced internal stress is also being studied in these materials, and preparation of specimens for preliminary measurements of transverse rupture strength are

being prepared. The metal–ceramic couples which were selected for study include Ta–SiC, W–SiC, and W–Al_2O_3. Apparatus and procedures for the tests are included along with data on hot pressing and thermal expansion. (J.R.D.)

7685 BMI-996

Battelle Memorial Inst., Columbus, Ohio.

ELECTROPLATED METALS ON URANIUM FOR ALUMINUM CLADDING. John G. Beach, William C. Schickner, Dolores Hopkinson, and Charles L. Faust. May 4, 1955. Decl. Jan. 8, 1960. 28p. Contract W-7405-eng-92. OTS.

The study of electroplated metals on uranium for aluminum cladding has defined the effects of several processing variables on the corrosion resistance. The quality of the uranium and the quality of the aluminum–nickel bond were important. Heat treatment and vacuum outgassing of the nickel-plated uranium prior to aluminum cladding were beneficial, and minimizing the amount of air present in the hot-press assembly was desirable. Variation in the steps for electroplating on uranium did not affect the corrosion resistance of aluminum-clad uranium. (auth)

7686 BMI-1024

Battelle Memorial Inst., Columbus, Ohio.

ENAMELS AND ENAMELING TECHNIQUES FOR COATING URANIUM SLUGS. Harlan P. Tripp, John Schultz, Burnham W. King, and Winston H. Duckworth. Aug. 2, 1955. Decl. Jan. 8, 1960. 14p. Contract W-7405-eng-92. OTS.

Porcelain-enamel coatings and application techniques were developed for the enameling of uranium slugs used in Hanford reactors. These coatings were developed for appraisal as thermal or diffusion barriers between the slug and its aluminum can. Variables in metal treatment, enamel composition, and firing conditions were investigated. Metal preparation for enameling was satisfactorily accomplished by an electropolishing process that formed a uranium phosphate film on the metal surface, thus inhibiting oxidation during the firing of the enamel. Of the enamels investigated, $Na_2O \cdot Al_2O_3 \cdot P_2O_5$ types fit the metal better than did those in the $PbO \cdot Bi_2O_3 \cdot SiO_2$ or $Na_2O \cdot PbO \cdot SiO_2$ systems. Firing conditions were not critical except that a short heating cycle was necessary, the most uniform coatings being developed in about 2.5 min of firing. The basic requirements for satisfactory enamels of adherence, uniform thickness and a smooth surface, and low thermal-neutron-absorption cross section were achieved. These coatings were not intended for applications requiring resistance to corrosive conditions. (auth)

7687 BMI-1208

Battelle Memorial Inst., Columbus, Ohio.

EVALUATION OF REACTOR CORE MATERIALS FOR A GAS-COOLED REACTOR EXPERIMENT. Donald L. Keller. July 11, 1957. Decl. Dec. 3, 1959. 94p. Contract W-7405-eng-92. OTS.

An evaluation of core materials for a gas-cooled reactor is being made. Work on the ZrH_n moderator has been confined to the high-hydrogen or delta-phase material. Methods for preparing sound hydride bodies of the high-hydrogen composition have been developed. Both solid hydride and hydride powder compacts are being clad by a pressure-bonding technique. The hot hardness, tensile strength, thermal conductivity, thermal-expansion coefficient, and dissociation pressure of the delta-phase material are being determined. Control-material development was directed at rare-earth-oxide dispersions in Ni-chrome V or Co alloys. The reference fuel element is dispersed-UO_2 in stainless steel. Studies include work on fabrication techniques and irradiation damage, and physical- and mechanical-property determinations. Several alternate fuels are being investigated. Gas-coolant studies involve N-metal and NH_4-metal reactions. Several additives to retard nitriding are being investigated. An in-pile-loop facility for testing reference materials is being constructed for operation in the Battelle Research Reactor. (auth)

7688 DMIC-120

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

A REVIEW OF CERTAIN FERROUS CASTINGS APPLICATIONS IN AIRCRAFT AND MISSILES. John Varga, Jr. Dec. 18, 1959. 53p. Contract AF18(600)-1375. (PB-151077). OTS.

A general summary of the application of steel castings to aircraft is presented. Representative types of castings are illustrated and discussed. The problems of the aircraft manufacturer and castings producer are presented. Future casting requirements and work that is in progress toward the increased use of castings are discussed. (auth)

7689 HW-28507

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

REMOVAL OF GRAPHITE FROM ALUMINUM SURFACES. R. L. Dillon and W. H. Hodgson. June 30, 1953. Decl. Jan. 28, 1960. 4p. OTS.

The removal of graphite from aluminum surfaces by an electrolytic etch, an anodization-deanodization cycle, and two chemical etches is described. The electropolishing method employing 60% H_2SO_4 and 1% HF at 140°C was found superior to any of the above methods; only 1.0 mil of Al was lost during the process. (C.J.G.)

7690 HW-29838

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE ANODIZING OF ZIRCONIUM. William E. Ray. Nov. 3, 1953. Decl. Jan. 29, 1960. 5p. OTS.

Strips of zirconium, anodized in a HNO_3–H_2SO_4 bath, were found to have good resistance to Al–Si at 630°C. (C.J.G.)

7691 HW-32156

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE GAS CONTAINED IN SLUG BOND LAYER VOIDS AND BLISTERS. F. A. Scott and H. J. Anderson. June 7, 1954. Decl. Jan. 29, 1960. 4p. Contract [W-31-109-Eng-52]. OTS.

A method for sampling and identifying the contents of cavities in metals was developed, and application of this method to analysis of bond layer void contents in the lead-dip canned slugs showed no residual gas. In hot-pressed canning of U slugs, gas blisters were found to contain air. Some CO_2 and H_2 present probably came from entrapped H_2O and organic matter. (T.R.H.)

7692 HW-32309

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE REMOVAL OF NICKEL PLATES FROM URANIUM. R. L. Dillon. June 25, 1954. Decl. Jan. 28, 1960. 5p. Contract [W-31-109-Eng-52]. OTS.

Nickel is removed from U by immersing for 15 min in one part 70% HNO_3, and one part water at 80°C with cold water rinsing. U dissolves in 50% by volume commercial HNO_3 at the rate of 0.1 mil/min at 80°C. A suitable construction material for the tank is corrosion-tested stainless steel. (F.S.)

7693 HW-42498(Del.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE EFFECT OF OXIDATION ON THE COMPRESSION STRENGTH OF CS-GBF GRAPHITE. Bruce Griggs. Apr. 11, 1956. Decl. Jan. 8, 1960. 12p. OTS.

Data on the effects of oxidation on the compressive strength of graphite are presented. Results indicate that a rapid decrease in compressive strength in unirradiated graphite during initial oxidation, with a more gradual decrease during further oxidation. Irradiated samples exhibited greater compressive strength than non-irradiated. (J.R.D.)

7694 K-1443
Oak Ridge Gaseous Diffusion Plant, Tenn.
SEMIAUTOMATIC CARBON ARC GOUGING MACHINE. J. J. Maginnis, J. L. Irons, and T. R. Rutkay. Feb. 12, 1960. 22p. Contract W-7405-eng-26. OTS.

Carbon arc gouging machine design and development for a specific application at the Oak Ridge Gaseous Diffusion Plant are reported. The machine replaces manually operated oxy-acetylene scarfing equipment previously used to open welded flanged joints of large steel vessels. Its use in repetitive gouging operations resulted in 60% and 75% reductions in equipment operating costs and over-all job costs, respectively. (auth)

7695 KAPL-M-SAB-1(Rev.)
Knolls Atomic Power Lab., Schenectady, N. Y.
FATIGUE TESTS OF S3G FUEL CELL TUBE STRUCTURE SECTIONS. S. Beitscher and G. L. Cutler. Dec. 17, 1959. 22p. Contract W-39-109-Eng-52. OTS.

Angle sections containing weldments were removed from S3G Zircaloy-2 fuel cell tube structures and subjected to cyclic unidirectional bending stresses. The sections were tested so that the bending stresses were a maximum at the fusion welded corners. Each section was cycled between zero applied stress and some constant deflection from the original rest position. The results of the tests of the angle section weldment indicate a fatigue life ranging from about 12,000 to over 200,000 cycles at nominal stress ranges from about 46,000 to 32,000 psi at room temperature. The relationship between fatigue notch factor and stress concentration factor was determined from measurement of the notch radii of the corners of the sections tested and the test results. The results indicate that the maximum fatigue notch factor is about 3, and that the factor increases as the stress concentration factor increases, and then decreases. (auth)

7696 NASA-TN-D-262
National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
URANIUM DIOXIDE COMPATIBILITY WITH REFRACTORY METALS, CARBIDES, BORIDES, NITRIDES, AND OXIDES BETWEEN 3500° AND 5000°F. James J. Gangler, William A. Sanders, and Isadore L. Drell. Feb. 1960. 28p. OTS.

The compatibility of uranium dioxide with 30 refractory materials was determined in vacuum or in argon for test times of 10 minutes and for test temperatures in the 3500 to 5000°F range. Hafnium carbide, tantalum nitride, tungsten, and tantalum were compatible with UO_2 up to 5000°F; molybdenum and niobium were compatible up to their melting points. Others were compatible at slightly lower temperatures. (auth)

7697 NP-8245
Lehigh Univ., Bethelehem, Penna. Fritz Lab.
LITERATURE SURVEY ON LATERAL INSTABILITY AND LATERAL BRACING REQUIREMENTS. Interim Report No. 43 [on] WELDED CONTINUOUS FRAMES AND THEIR COMPONENTS. Fritz Lab. Report 205H.2. George C. Lee. Oct. 1959. 58p. For American Inst. of Steel Construction and American Iron and Steel Inst. U.S. Navy Contracts 39303 and 610(03).

This literature survey is limited to a general survey of the existing solutions to the problem of lateral buckling of metal structures, with emphasis on three points. Point number one is an extensive list of references including those that may be helpful for the lateral bracing problem. Number two is a description of several important papers particularly concerned with inelastic solutions. Number three gives a general historical sketch of the problem of lateral instability. (W.L.H.)

7698 NP-8280
Buffalo. Univ.
PROGRESS REPORT NO. 8 FOR OCTOBER 1, 1959 TO DECEMBER 31, 1959. J. F. Andrew, N. Juul, J. Okada, H. E. Strauss, and S. Mrozowski. Jan. 13, 1960. 17p. Contract AF33(616)-5186.

Studies were made on the elastic properties of carbons and graphites at room and at high temperatures in relation to some of the fabrication and structural variables and to investigate heat conduction and heat diffusivity of graphites at high temperatures. Results are presented on the determination of Young's modulus for soft graphitized filler rods and the dependence on heat-treatment temperature. Further results of a study are reported on the influence of connection through pores on the measured value of thermal conductivity and thermal diffusivity determinations in the range 760 to 2870°C for commercial graphites. (W.L.H.)

7699 NP-8343
Canada. Dept. of Mines and Technical Surveys. Mines Branch.
RADIOACTIVE MARKING OF STEEL BALLS FOR GRINDING TESTS. G. G. Eichholz. Nov. 20, 1959. 9p.

Available as Can. Dept. Mines and Tech. Surveys, Mines Branch, Tech. Bull. TB-12. $0.25.

Tests were performed to label steel balls with radioactive iron for investigations on the life and wear of the balls under operating conditions in grinding circuits. The method of introduction of the tracer and the monitoring procedure are discussed in detail. (auth)

7700 ORNL-1161(Del.)
Oak Ridge National Lab., Tenn.
METALLURGY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING OCTOBER 31, 1951. W. H. Bridges, ed. Apr. 21, 1952. Decl. with deletions Nov. 12, 1959. 56p. Contract W-7405-eng-26. OTS.

Eleven thorium–carbon alloys in the range 0.02 to 2.0% carbon were prepared by vacuum-arc melting. The hardness varied from 19 R_A for the 0.02% alloy to 108 R_B for the 2.0% alloy. The preparation of thorium–chromium alloy was hampered by a reaction with the zirconia molds, which results in porosity in the casting. The failure of aluminum–silicon bonded X-10 slugs after heat treatment for seven days at 400°C was traced to the failure to remove tin after the tin dip and the presence of a gas during heat treatment. Tensile tests were made on extruded thorium, and no correlation was found with extrusion variables. A composition effect was found, however, which showed a linear relationship between carbon content and tensile strength. Creep tests on thorium, uranium, and Inconel continue. The program of evaluating the variables in the fabrication of clad fuel elements, using MTR techniques, was concerned mainly with the distribution of UO_2 in the

core compact, the temperature of rolling, and the particle size of the metallic core powder. Progress is being made in the preparation of three-layer laminates without the use of a protective can during the hot-rolling operation but with the use of a hydrogen atmosphere during the preparatory heating. Molten hydroxides of barium, sodium, strontium, lithium, and potassium and molten sodium cyanide were used in corrosion tests at 1500°F. Nickel, copper, and Monel appear to be the only commercially available materials that resist chemical reaction with the molten hydroxides and sodium cyanide at this temperature. Mass transfer, however, presents a difficult problem. Stainless steels coated with copper and nickel are a logical development and heavier coatings show promise. Nitrogen and carbon diffusion into metal appears as a primary difficulty in containing sodium cyanide at 1500°F in a number of commercial alloys. Nickel and iron, however, give no evidence of interaction. The stainless steels vary in their tendency to interact. Mass transfer in thermal convection loops continues to cause early termination of runs in which the liquid media is a hydroxide. In tests, tubes under helium pressure are immersed into a bath of the desired liquid and left for 1000 hr or until failure. Type-316 stainless steel and Inconel were tested. Early failure of the Inconel is believed to be due to faulty tubing, since tubing from a new batch has been under test for some time without signs of failure. The diffraction of neutrons by liquid metals was attempted to gain information on the structure of liquids. Both lead and bismuth were run in a specially designed furnace that fits the neutron spectrometer. A mathematical analysis of the data is under way. The basic studies on the interactions of solid and liquid metals continue. By careful control of temperature gradients and of thermal cycling, mass transfer in copper-bismuth systems could be made either negligible or appreciable. The largest temperature deviation that can be tolerated in thermal cycling of a static system is 2°C. A basic study was started to determine the effect of oxygen on the corrosion of metals by sodium hydroxide. Thermal convection loops are being run to determine the effect of oxygen on a dynamic sodium hydroxide–nickel system. The first loop was stopped after over 300 hr of operation. Appreciable mass transfer occurred in this loop, which had been loaded in a helium atmosphere and sealed off under vacuum. The feasibility of cone-arc welding of tube-to-header joints was demonstrated. Spot welding was shown to be a good method for joining tube-bundle straps to fuel tubes. (For preceding period see ORNL-1108.) (auth)

7701 SCNC-254

Sylvania-Corning Nuclear Corp., Bayside, N. Y.

TECHNICAL PROGRESS REPORT FOR PERIOD JULY 1 TO AUGUST 31, 1957. Dec. 15, 1957. Decl. Jan. 8, 1960. 20p. Contract AT-30-1-GEN-366. OTS.

Progress is reported on dimensionally stable U alloys, hydrostatic pressing, non-oxide dispersions, UO_2 fuel elements, Graphite fuel elements, ultra-high temperature fuel elements, nondestructive testing, dimensional instability of U, self-diffusion of Nb, fundamentals of diffusional bonding, and fundamentals of sintering. (W.L.H.)

7702 SCNC-261

Sylvania-Corning Nuclear Corp., Bayside, N. Y.

QUARTERLY TECHNICAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1957. Mar. 20, 1958. Decl. Jan. 8, 1960. 61p. Contract AT-30-[1]-GEN-366. OTS.

Development of metallurgical methods for preparation of U-rich alloys and cermets which are resistant to thermal cycles through the phase transformation as well as to swelling caused by the expansion of fission product gases at high temperatures is described. A technique for cold and hot pressing of complicated shapes suitable for reactor components is described. Development of non-oxide dispersion-type fuel elements is outlined, and a fuel element with good dimensional stability under high temperature, high flux irradiation, consisting of a dispersion of U metal in a high melting point, metallic matrix is described. Developments in non-destructive testing methods are reported. Development of high-UO_2 ceramic and cermet bodies having physical properties which are well suited to fuel element applications is described. Development of a stable complex carbide for high temperature applications in either an oxidizing or a reducing atmosphere is reported. A spherical UC-graphite fuel element having sufficient strength, impact, and thermal shock resistance for application in the Process Heat Reactor was developed. (W.L.H.)

7703 TID-3110

Technical Information Service Extension, AEC.

PRODUCTION OF THORIUM METAL: A BIBLIOGRAPHY OF SECRET U. S. ATOMIC ENERGY COMMISSION REPORTS AVAILABLE THROUGH THE CIVILIAN APPLICATION PROGRAM. Oct. 1956. Decl. Jan. 8, 1960. 10p. OTS.

A bibliography of 53 references on the production of thorium and closely related topics is presented. (C.J.G.)

7704 USBM-U-672

Bureau of Mines. Albany Metallurgy Research Center, Oreg.

QUARTERLY METALLURGICAL PROGRESS REPORT NO. 5 [FOR] THE PERIOD OF OCTOBER 1, 1959 TO DECEMBER 1959. 27p. Contract AT(11-1)-599. OTS.

Investigations are being made to develop new methods for preparing high-purity yttrium metal. Research during the past quarter centered largely on the development of methods for preparing pure anhydrous yttrium iodide and the subsequent reduction of the iodide to metal. Methods for preparing anhydrous yttrium bromide were also investigated. Fabrication studies were continued to determine further the working characteristics of high-purity yttrium. These studies included hammer and press forging, cold rolling, extrusion and annealing tests. A modified procedure for chlorinating calcined thorium oxalate was developed. Varying distillation temperature and retort pressure reduced the amount of entrained solids in purified thorium tetrachloride. Modifications in reduction equipment designed to prevent volatilization of sodium from the reaction crucible were partially successful. An ingot melted from selected material had an as-cast Brinell hardness (500 kg load) of 35 and an annealed hardness of 28. This material was cold-forged 68%. Attempts to reduce UF_6 with lithium, calcium, magnesium, and antimony failed to produce a satisfactory uranium metal sponge. Research was continued on the development of an economical process for the extraction of zirconium-hafnium values from zircon sand, and the preparation of an enriched hafnium fraction for feed to a suitable solvent extraction scheme. Studies on fluoride roasting of zircon followed by fractional crystallization of the zirconium fraction, and upgrading of hafnium tetrachloride by selective disproportionation are being conducted. Preliminary results from a set of 64 samples conducted on a statistical basis showed no further improvement was obtained in extraction efficiency. Approximately 50% of the combined zirconium and hafnium values were extracted by leaching a reacted mix-

ture of zircon and K_2SiF_6 with dilute hydrofluoric acid solution. Results from three additional selective disproportionation tests showed that the hafnium content was enriched from 3.2 to 5.6% (based on a ratio expressed as Hf/Hf + Zr × 100). Hafnium-vanadium alloys were prepared by arc-melting and suction casting. The investigation of the zirconium-gadolinium phase diagram was completed. The diagram is a simple eutectic system with limited terminal solubility of gadolinium in alpha and beta zirconium phases, and of zirconium in gamma and delta gadolinium phases. The investigation of stainless steel (304)–gadolinium pseudo-binary phase diagram was initiated. No difficulty was encountered in consolidating selected alloy compositions by nonconsumable arc-melting. As-cast alloys are being subjected to melting point determinations and hot swaging. Investigation to determine phase diagrams for the binary systems, titanium-gadolinium, titanium-iridium, and titanium-europium were continued. A total of nine air-cooled arc melts completed in one of the herringbone-finned crucibles are being evaluated. Of these nine heats, six were iron, one was titanium, and two were zirconium. Machined crucibles are being produced from the free machining copper-lead and copper-tellurium alloys in an effort to determine the feasibility of producing machined crucibles for air cooling. Fifty air samples taken from the various thorium handling areas have been analyzed by decay count procedures. In addition, three representative samples have been sent to the University of California Lawrence Radiation Laboratory for alpha-pulse height analysis. Although no definite conclusions can be made as to hazards presented, an idea of the relative dangers of given operations can be drawn from the initial activities. Compression strength and density values were determined on eighty expendable graphite mold specimens and a series of castings is being produced using expendable material BW. (For preceding period see USBM-U-647.) (auth)

7705 WADC-TR-55-243(Pt.II)
Metallwerk Plansee, Reutte, Tyrol, Austria.
DEVELOPMENT OF ALLOYS HAVING GOOD HIGH TEMPERATURE PROPERTIES THROUGH POWDER METALLURGY TECHNIQUES. [Period covered] December 1, 1956 to December 31, 1958. R. Kieffer and F. Benesovsky. Dec. 31, 1958. 156p. Project title: METALLIC MATERIALS. Task title: REFRACTORY METALS. Contract AF61(514)-1144.

Wet milled powder mixtures of Fe–Al–Mo 80-14-5-TiC/Cr_3C_2 alloys with 0 to 30% of 90–10 TiC/Cr_3C_2 mixed crystals were sintered in a vacuum and their properties were evaluated. With increasing additions of carbide mixed crystals the hot strength increases; however, the alloys become brittle. The reinforcing of these alloys by means of Ni–Cr, megapyr, or molybdenum wire and nets pressed into the powder compacts increases the impact strength provided no reaction occurs between the alloy and the reinforcing structure. (auth)

7706 WADC-TR-59-102
Marquardt Aircraft Co., Van Nuys, Calif.
DEVELOPMENT AND EVALUATION OF INSULATING TYPE CERAMIC COATINGS. Period covered: March 1, 1958 through February 28, 1959. E. W. Blocker, C. A. Hauck, S. Sklarew, and A. V. Levy. Feb. 28, 1959. 70p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-5441. OTS.

A metal reinforced ceramic coating system has been developed that will successfully withstand temperatures of 3500°F while providing insulative values for the supporting structure. This ceramic coating system utilizes a corrugated strip of stainless steel as the reinforcement media and phosphate bonded alumina as the refractory medium. The great advantage of a coating system of this nature, aside from the high temperature resistance and thermal insulation, is the wide variety of applications wherein it can be utilized. Attempts have been made to use zirconia as the refractory grain in phosphate bonded reinforced coatings. These attempts have not been wholly successful, due mainly to the poor thermal shock resistance of zirconia. It is anticipated that this drawback can be eliminated. Several items of research equipment have been designed and built to facilitate study of the various ceramic materials used in this program. These include a differential thermal analysis setup, a high temperature modulus of rupture furnace, and a modification of the existing thermal drop apparatus.

7707 WADC-TR-59-280
Climax Molybdenum Co. of Michigan, Detroit.
DEVELOPMENT OF MOLYBDENUM-BASE ALLOYS. PART I. HIGH STRENGTHS AND HIGH RECRYSTALLIZATION TEMPERATURES IN WROUGHT MOLYBDENUM-BASE ALLOY BAR STOCK. PART II. MOLYBDENUM-BASE ALLOY SHEET MATERIALS. [Period covered] January 1, 1958 to December 31, 1958. M. Semchyshen, Gordon D. McArdle, and Robert Q. Barr. July 15, 1959. 136p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-5447. OTS.

Some significant advances have been made in the development of molybdenum-base alloys. Of several investigated, one exhibited an ultimate tensile strength at room temperature of 155600 psi and 101300 psi at 1800°F. Another showed a one-hour recrystallization temperature in excess of 3200°F. A third alloy had a 100 hour rupture strength of 32700 psi at 2400°F. These represent the strongest known metallic materials for service at 1800°F to 2400°F. Nominally $\frac{1}{16}$" thick sheet was fabricated from some of the alloys. While this sheet exhibited recrystallization temperatures comparable to those of wrought bar stock of the same composition, the tensile strengths and uniform elongations were lower for the sheet material. Annealing temperatures sufficient to recrystallize the cone of the alloy sheets were inadequate to recrystallize the extreme surface layers. This "case effect" is attributed to contamination of the surface during rolling and annealing. Bendability of the sheet alloys was substantially increased by milling off these outer layers. (auth)

7708 WAPD-ZH-21
Westinghouse Electric Co. Bettis Atomic Power Lab., Pittsburgh.
ZIRCONIUM HIGHLIGHTS. Dec. 1959. 25p. Contract AT-11-1-GEN-14. OTS.

Zircaloy-2 corrosion test coupons showing flecking type markings in the black oxide coatings developed during corrosion testing suggested that there was a relation with the structure of the metal surfaces exposed to the test. Studies were made on the corrosion and hydrogen pickup behavior of Zircaloy-2 and -4 exposed to 600 and 680°F water and 750°F steam. The tensile properties of Zircaloy-2 in a PWR subassembly were investigated. A program was initiated to determine the mechanical properties of weld-deposited Zircaloy-2. (For preceding period see WAPD-ZH-20.) (W.L.H.)

7709 AEC-tr-3956
HIGH-MELTING FUEL MATERIALS AND HIGH-

TEMPERATURE FUEL ELEMENTS. G. A. Meerson. Translated by Lydia Venters (Argonne National Lab.) from Atomnaya Energ. 6, 135(1959). 8p. JCL or LC.

Papers and displays from various countries presented at the Geneva Conference are summarized on the problems of production and use of fuel elements with UO_2 cores in tubular and plate type cladding as well as the problems of using carbides and oxides of U and Th as fuel elements for high-temperature (to 1000°C) reactors. (W.L.H.)

7710 JPRS-2104-N

SELECTED TRANSLATIONS ON SOVIET HIGH-TEMPERATURE METALLURGY. [1959]. 107p. OTS.

Translations of selected articles from Soviet literature on research and development in the areas of high-temperature metals and alloys, foundry practices, forming techniques, welding technology, high-temperature brazing, highly stable lightweight structures, corrosion and coatings, and testing are presented. (J.R.D.)

7711

THE SYSTEM ZrO_2–GeO_2. Jean Lefèvre and Robert Collongues (Centre National de la Recherche Scientifique, Paris). Bull. soc. chim. France No. 11-12, 1966-7(1959) Nov.-Dec. (In French)

The equilibrium diagrams between zirconium oxide and the oxides of the tetravalent metals are, in general, well known and relatively simple. The ZrO_2–GeO_2 system is distinguished very clearly from the other ZrO_2–MO_2 systems. The germanium oxide possesses the curious property of stabilizing the quadratic form of the zirconium oxide up to room temperature. The $ZrGeO_4$ phase has a very extended range of homogeneity. (tr-auth)

7712

THE NATURE OF THE CUBIC PHASES OF THE ZrO_2–La_2O_3 SYSTEM. Monique Perez Y Jorba and Robert Collongues (Centre National de la Recherche Scientifique, Paris). Bull. soc. chim. France No. 11-12, 1967-8(1959) Nov.-Dec. (In French)

The ZrO_2–La_2O_3 system was studied between room temperature and 2800°C. The formation of a stable non-stoichiometric compound of the $La_2Zr_2O_7$ pyrochlore type was found, and the limits of its range of homogeneity were determined. For compositions remote from the stoichiometric composition $La_2Zr_2O_7$, a cubic phase of the "stabilized zirconium oxide" type appears which is stable at high temperature. (tr-auth)

7713

THE EQUILIBRIUM DIAGRAMS OF ZIRCONIUM OXIDE–RARE EARTH OXIDES. Jean Lefèvre, Monique Perez Y Jorba, and Robert Collongues (Centre National de la Recherche Scientifique, Paris). Bull. soc. chim. France No. 11-12, 1969-71(1959) Nov.-Dec. (In French)

The systems ZrO_2–La_2O_3, ZrO_2–Nd_2O_3, ZrO_2–Gd_2O_3, and ZrO_2–Sm_2O_3 were studied. The results showed the stability of solid solutions of trivalent oxide in quadratic zirconium oxide. Some remarkable properties of these phases were studied. The existence of two types of cubic phases was shown. One phase is a non-stoichiometric compound of the pyrochlore type which appears in all the systems studied in the vicinity of the $2ZrO_2$–M_2O_3 composition. The extent of its region of homogeneity was determined at different temperatures. The second phase is a cubic solid solution of the fluorine type which appears in the equilibrium diagram on both sides of the pyrochlore phase. The extent of its region of homogeneity and its stability depends greatly on the nature of the trivalent oxide. For example, the region of homogeneity of the solid cubic solution ZrO_2–La_2O_3 has a eutectoid point. The solid cubic solution ZrO_2–Nd_2O_3, however, is stable up to room temperature. These results permitted the equilibrium diagrams of zirconium oxide–rare earth oxide systems to be defined. (tr-auth)

7714

METALS FOR THE NEW AGE. I.C.I. ADDS WROUGHT BERYLLIUM TO ITS PRODUCTION OF 'NEW' METALS. Chem. & Process Eng. 41, 32-3(1960) Jan. (In English)

Production methods and safety hazards in the production of beryllium, titanium, and zirconium are discussed. Applications of the metals are given. (C.J.G.)

7715

DEVELOPMENT OF URANIUM METAL PRODUCTION IN AMERICA. H. A. Wilhelm (Ames Lab., Iowa). J. Chem. Educ. 37, 56-68(1960) Feb.

A historical development of uranium production in the United States is given. (C.J.G.)

7716

THE FORMATION ENERGY OF VACANCY OF METAL. Wang Yung-Chiang (Chekiang Univ. China). Wu Li Hsüeh Pao 15, 469-74(1959) Sept. (In Chinese)

The formation energy of a vacancy is calculated from the surface tension of a solid. It was found that the theoretical values of vacancy formation energy of metals agree with experimental values. The vacancy formation energies of metals are directly proportional to energies of self-diffusion and melting points. The ratio of the energy of vacancy formation to the energy of self-diffusion, determined by one of the above proportional relations, is 0.43. The vacancy formation energy is also a periodic function of atomic number. (auth)

7717

GRAPHITE WHISKERS. L. Meyer (Univ. of Chicago). p.451-7 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

Filamentary growth of graphite was observed while coating carbon filaments with graphite by decomposing hydrocarbons. A well developed whisker of 1.3 mm length and 0.1 mm diameter was studied in detail. The whisker shows fiber structure, with the graphite planes being parallel to the whisker axis. All evidence suggests that the whisker grew from its base by diffusion of carbon atoms into the high energy boundary between the whisker and the matrix. (auth)

Corrosion

7718 AERE-C/M-353

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECT OF SURFACE PREPARATION AND NEUTRON IRRADIATION ON THE CORROSION OF ZIRCALOY-2 IN HIGH TEMPERATURE AQUEOUS SOLUTIONS. B. Cox and K. Alcock. July 1958. 10p. (GCHW/FEWP/P10).

Experimental evidence indicates that Zircaloy-2 corrosion in high-temperature aqueous solutions is insensitive to surface preparation. Experiments in BEPO show that there is no significant effect of neutron and γ irradiation on the corrosion of Zircaloy-2 in aqueous solutions at 300°C. It is suggested that similar conclusions may be applied to corrosion by steam. (auth)

7719 BMI-1402

Battelle Memorial Inst., Columbus, Ohio.

EFFECT OF ADDITIONS TO ZIRCALOY ON HYDROGEN PICKUP DURING AQUEOUS CORROSION. Warren E.

Berry, Earl L. White, and Frederick W. Fink. Dec. 29, 1959. 32p. Contract W-7405-eng-92. OTS.

An investigation was conducted into the possibility of alloy additions to Zircaloy-2 to diminish hydrogen absorption during aqueous corrosion. The nickel in Zircaloy-2 is believed to be the major constituent responsible for the relatively high hydrogen absorption. Additions of up to 0.5 wt.% antimony, arsenic, bismuth, or tellurium were selected on the basis of their known ability to poison the catalytic effects of nickel in hydrogenation reactions of other systems. Results of tests conducted for a total of 224 days in 600 and 680°F water and 750°F steam revealed no decrease in hydrogen absorption in modified Zircaloy-2 containing the aforementioned alloy additions. Hydrogen absorption increased when these alloying elements were present in the range of 0.1 to 0.2 wt.%. Corrosion resistance also decreased with alloy additions in these ranges. A 2-atm. partial pressure of hydrogen in the steam or above the water did not affect hydrogen absorption in the alloys appreciably. The hydrogen partial pressure did not affect time to transition in corrosion rates, but did appear to produce higher weight gains than degassed water. (auth)

7720 OMCC-HEF-169

Syracuse Univ., N. Y.

MASS TRANSFER IN LIQUID LITHIUM FORCED-CONVECTION SYSTEMS. W. N. Gill and E. J. Walker. Dec. 16, 1958. 41p. For Olin Mathieson Chemical Corp. AMC Project 7-558-C. Contract AF33(600)-33920. (AD-217976).

Mass transfer rate in a type 304 stainless steel loop containing liquid lithium was studied under various temperature and velocity conditions. Results indicate that the stainless steel is compatible with lithium in systems at 400°C or less. No serious corrosion or mass transport problems were noted. Chemical reactions causing corrosion were principally due to impurities; however, filtration reduced these to tolerable levels. (J.R.D.)

7721 ORNL-2870

Oak Ridge National Lab., Tenn.

TOROID ROTATOR FOR SMALL-SCALE DYNAMIC CORROSION STUDIES—DESIGN, FABRICATION, AND OPERATION. R. M. Warner, G. E. Moore, and H. C. Savage. Nov. 15, 1956. 25p. Contract W-7405-eng-26. OTS.

A description of the four-toroid rotator, a relatively simple apparatus particularly applicable to the determination of the corrosive effects of flowing solutions or slurries on structural materials, is presented in detail. In this apparatus flow of a liquid medium at known velocities is induced in a circular section of pipe without the use of pumps. Included are details of mechanical design, descriptions of equipment and instrumentation, a list of fabrication costs, and a discussion of operational experience. (auth)

7722

CORROSION CONSTANTS OF ALLOYS WITH URANIUM BASE. [PART] I. M. J. Brabers. Atoomenergie 2, 1-7(1960) Jan. (In Dutch)

In this first part of the article the corrosion of unclad uranium alloys is investigated. The corrosion properties of U—Mo, U—Nb, U—Mo—Nb, other ternary alloys with a U—Mo base, and U—Si alloys were given. (tr-auth)

7723

HIGHER PURITY BOOSTS ZIRCONIUM RESISTANCE. W. E. Kuhn (Carborundum Co., Niagara Falls, N. Y.). Chem. Eng. 67, No. 3, 154; 156; 158; 160(1960) Feb. 8.

Corrosion data on four grades of zirconium (iodide, reactor, vacuum-melted, and argon-melted) are presented. The corrosive effects of HCl, H_2SO_4, HNO_3, impurities, iron, and copper on zirconium are discussed. The effects of electrolyte polishing and vacuum annealing in reducing surface breakaway are reported. Fabrication and welding problems are described. (C.J.G.)

7724

THE INVESTIGATION OF CORROSION FAILURES OF FERROUS METALS. E. E. White and K. A. Chandler (British Iron & Steel Research Assn., [Eng.]). Chem. & Ind. (London) No. 33, 1028-35(1959) Aug. 15.

Methods of investigating corrosion failures of ferrous metals are discussed, and the assessment of corrosion damage and protective measures by laboratory and field tests are evaluated. The application of these methods to the assessment of corrosion damage and protective measures for corrosion of ferrous metals by air, fresh water, soil, concrete, and marine and river water is discussed. (C.J.G.)

7725

THE ACTION OF CATHODICALLY EVOLVED HYDROGEN ON IRON AND NICKEL AS SPECIAL CASES OF CORROSION—EMBRITTLEMENT OF METALS. Michael Smialowski (Polish Academy of Sciences, Warsaw). Chem. & Ind. (London) No. 35, 1078-83(1959) Aug. 29.

The embrittlement of iron and nickel by cathodically evolved hydrogen was studied using electrochemical and metallurgical methods simultaneously. The relation between the binding force of the hydride of a poisoning element (present in acid solution) and the ability to provoke deformation of an iron cathode are discussed. The elongation and time to fracture of iron, carbon steel, and nickel were determined. Iron and carbon steel absorbed small quantities of hydrogen whereas nickel absorbed great quantities. (C.J.G.)

7726

OBSERVATIONS ON THE MECHANISM OF ATTACK OF ALUMINUM—IRON—NICKEL ALLOYS IN WATER VAPOR ABOVE THE CRITICAL TEMPERATURE. Pierre Lelong, Jacques Moisan, and Jean Herenguel. Compt. rend. 250, 340-2(1960) Jan. 11. (In French)

It was observed that starting at 430°C Al—Fe—Ni alloys undergo a violent attack at centers which extend to total destruction of the sample. Micrographic examination of the solidification texture showed a selective penetration between solid solution and eutectic around the centers of attack. (tr-auth)

7727

DEMONSTRATION OF INTERGRANULAR SEGREGATION BY CHEMICAL ATTACK OF ALUMINUM BICRYSTALS. Claude Goux (Centre National de la Recherche Scientifique, Paris). Compt. rend. 250, 343-5(1960) Jan. 11. (In French)

It is shown that the presence of a boundary leads to a phenomenon of segregation of impurities in the equilibrium state. The enrichment of foreign atoms remains very low but is manifest for considerable differences, 75 μ in the case examined. (T.R.H.)

7728

HIGH-TEMPERATURE, HIGH-PRESSURE OXIDATION OF ALLOYS CAUSED BY CARBON DIOXIDE. J. C. Bokros and W. P. Wallace (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Corrosion 16, 73t-8t(1960) Feb.

The oxidation behavior of 26 alloys by high-pressure carbon dioxide in the range 1000 to 2000 psi CO_2 at 1100 to 1740°F is described. The oxidation rates of heat-resistant alloys in 2000-psi CO_2 at 1300 and 1500°F were

very low. The oxidation followed a parabolic or slower rate law. At 1740°F, most of the alloys exhibited excessive scaling in 1000-psi CO_2. Scales were protective in all cases. (auth)

7729

QUALIFICATION OF INCONEL FOR NUCLEAR POWER PLANT APPLICATIONS. Harry R. Copson (International Nickel Co., Inc., Bayonne, N. J.) and Warren E. Berry (Battelle Memorial Inst., Columbus, Ohio). Corrosion 16, 79t-85t(1960) Feb.

Corrosion tests were conducted in simulated primary and secondary reactor waters on Inconel specimens in varied conditions of heat treatment and composition. Stressed specimens, weldments, galvanic couples, and crevice specimens were included. Under all conditions a tightly adherent film formed on the specimens and the corrosion rates were comparable to those of austenitic stainless steels. The Inconel alloy does not suffer intergranular attack or stress corrosion cracking in reactor waters. (auth)

7730

CORROSION TESTING OF TWO ZIRCONIUM ALLOYS. Stanley Kass (Westinghouse Electric Corp., Pittsburgh). Corrosion 16, 93t-9t(1960) Feb.

The influence of the testing method on the high-temperature water and steam corrosion properties of Zircaloy-2 and Zircaloy-3 was studied. It is shown that surface preparation and the manner of performing the corrosion test greatly influences the corrosion behavior. Cleaning, pickling, and rinsing surfaces and autoclave preparation, operation, and cleanliness are described. Pre-test requirements are discussed. (auth)

7731

THE CORROSION OF ALUMINIUM AND ITS ALLOYS IN HIGH-PRESSURE STEAM. N. J. M. Wilkins and J. N. Wanklyn (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inst. Metals 88, 134-40(1959) Nov.

An aluminum alloy Aereal 1 (2.5 wt.% nickel), was exposed to steam at temperatures from 270 to 500°C for periods up to one week. Three distinct types of corrosion were observed: uniform film growth, penetrating attack, starting from points and spreading over the whole surface, the final product being a fine grey powder, and "growth" of the specimen. Up to 350°C, uniform corrosion was the rule, and instances of rapid failure were very few. At 325°C and constant pressure, the uniform corrosion followed a parabolic law, the rate constant having a high pressure-dependence (approximately $\propto p^4$). At 400°C and above, a high proportion of specimens showed penetrating attack. Growth was found only at 500°C. Sintered aluminm powder (S.A.P.) samples were also tested. At 350°C and below their resistance was very poor. At 500°C, however, S.A.P. seemed notably less liable than Aereal 1 to penetrating attack. S.A.P. containing 1 wt.% nickel was also tested. This material appears to combine the good resistance of the nickel alloy at lower temperatures (~300°C) with the resistance of ordinary S.A.P. to penetrating attack at 500°C. (auth)

7732

LOCALISED PENETRATING CORROSION OF A SINTERED ALUMINIUM POWDER ALLOY IN HIGH TEMPERATURE STEAM. C. F. Britton and N. J. M. Wilkins (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Materials 1, 374-6(1959) Dec. (In English)

The effects of testing conditions on localized penetrating corrosion studies of a sintered aluminum powder alloy in high temperature steam were studied. A simulation of the penetrating attack was observed when hydrogen was added to the steam. (C.J.G.)

7733

METHOD OF CONTROLLING CORROSION IN A NEUTRONIC REACTOR. C. P. Kidder and C. K. Sloan (to U. S. Atomic Energy Commission). U. S. Patent 2,907,689. Oct. 6, 1959.

A method is described for reducing or removing corrosion and iron deposits on aluminum surfaces from coolant water comprising adding to the coolant alkali metal dichromate in a concentration of between 1.8 and 2.2 ppm, adjusting the pH to between 7.3 and 7.8 by adding $CaCO_3$ or other similar material, and adding a silicious material such as diatomaceous earth of a particle size of 5 to 15 microns to effect a suspension of between 2 and 300 ppm and circulating it through the reactor.

Fabrication

7734 AD-161884

Frankford Arsenal. Pitman-Dunn Lab., Philadelphia.
RADIOTRACER STUDY OF THE EFFECT OF LUBRICANTS ON METAL TRANSFER IN DRAWING BRASS. C. Fisher, S. Berk, A. Shapiro, and M. Petronio. Dec. 1957. 21p. DA Project No. 5B9321059. (R-1423).

A study was made of the effect of lubricants on metal transfer in a drawing operation using radioactive tracer techniques. The experimental system consisted of drawing a caliber 0.30 brass draw piece plated with brass containing zinc-65 and measuring the radioactivity transferred to the die. Results showed that there is a continual interchange of brass between the die and the work and that the amount of brass transferred is related to the draw forces. Sulfurized lard oil and sulfurized mineral oil resulted in the least metal transfer to the dies. Lard oil and oleic acid resulted in an intermediate amount of transfer, while the chlorinated oil, soap, and straight mineral oil resulted in the largest amount of metal transfer. The radioactive tracer technique may be used to study metal transfer and to evaluate lubricants in the drawing operation. (auth)

7735 AD-218546

Beryllium Corp., Reading, Penna.
BERYLLIUM CASTING. Interim Technical Engineering Report No. 3 [for] March 19, 1959–June 18, 1959. Phase II. Paul M. Cohen. 143p. Project No. 7-643. Contract AF33(600)-37902.

The contamination study, consisting of approximately a dozen heats, was performed to determine the effect of crucible and mold materials on ingot purity. This was completed during this period and most of the results are reported. Some of the chemical analyses for this study and the arc melting phase of the melting study are unavailable and will be reported in the next quarterly report. The melting study was completed and the results of arc melting phase are discussed. (auth)

7736 AD-226215

Republic Aviation Corp., Farmingdale, N. Y.
FORMING OF INCONEL X. Interim Technical Report No. 3 [for] April 2, 1959 to July 1, 1959. R. Germann and C. J. Shaver. 33p. Contract AF33(600)-38042.

A resumé of test data concerning the evaluation and the establishment of fabrication limits and techniques of Inconel X sheet material is presented. Conventional methods of forming operations were utilized to fabricate prototype or representative airframe structural parts. In processing these parts, maximum forming limits have been

established. Sheet materials of 0.025", 0.040", 0.062", and 0.093" gages were used throughout the various tests and fabrication stages. Parts were formed and fabricated at room temperature in the annealed condition, but wherever it was found practical or advisable, details were also formed from age hardened material (aging at 1300°F/20 hours). (auth)

7737 APEX-538

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

CASTING OF ZIRCONIUM CONTAINING SMALL INTERNAL COOLING HOLES. D. S. Parker. Nov. 1959. 11p. Contracts AF33(600)-38062 and AT(11-1)-171. OTS.

The possibility of casting zirconium containing long, small-diameter, internal cooling holes was investigated. Castings were made containing core materials of cerium sulfide, steel, copper, and graphite. All core materials failed because of either breakdown of core material, melting, or lack of structural stability. No further work is anticipated in this area. (auth)

7738 BMI-989

Battelle Memorial Inst., Columbus, Ohio.

EXTRUSION CLADDING OF FUEL ELEMENTS. C. J. Slunder, R. J. Fiorentino, and A. M. Hall. Mar. 22, 1955. Decl. Jan. 8, 1960. 32p. Contract W-7405-eng-92. OTS.

A technique was developed whereby seamless aluminum clads of uniform and controlled thicknesses can be extruded concentrically over uranium cores of various shapes. Excellent adhesion was obtained between the extruded aluminum layer and the uranium core. (auth)

7739 BMI-1015

Battelle Memorial Inst., Columbus, Ohio.

FURTHER STUDIES ON LARGE-BATCH MELTING OF URANIUM. George W. Rengstorff and Harold W. Lownie, Jr. July 11, 1955. Decl. Jan. 8, 1960. 30p. Contract W-7405-eng-92. OTS.

Investigations on the feasibility of melting uranium in open induction furnaces were conducted. One-ton heats were successfully poured in cast iron ingot molds. Rammed linings of MgO plus Al_2O_3 and preformed crucibles of MgO were used successfully for melting. Heats of 10 tons or more can be made in production furnaces without the use of a vacuum. One ingot weighing 1200 lb analyzed 0.01 wt.% carbon and 0.006 wt.% nitrogen. This ingot contained 0.0005 to 0.0009 wt.% hydrogen, even though it was melted in a preheated furnace without a salt cover in order to eliminate contamination by water from the furnace or salt. Thereafter, a series of tests on 170-lb ingots showed that flushing with argon or chlorine for a short time just before pouring could reduce the hydrogen content to 0.0003 to 0.0004 wt.%. The recovery of uranium in the ingot was consistently 93 to 97% of the weight of the charge when the time of melting was kept at 1¼ hr or less. This high recovery was obtained either with or without a protective salt cover. (auth)

7740 BMI-1021

Battelle Memorial Inst., Columbus, Ohio.

PLASTIC FLOW DURING EXTRUSION OF TUBING. Henry A. Saller, John R. Keeler, and Lee J. Cuddy. July 26, 1955. Decl. Jan. 8, 1960. 18p. Contract W-7405-eng-92. OTS.

The effects of two extrusion variables, die angle and billet shape, on the flow characteristics of U during extrusion were estimated from results obtained in a study of the flow of Plasticine in a small-scale extrusion press. (C.W.H.)

7741 BMI-1040

Battelle Memorial Inst., Columbus, Ohio.

PLASTIC DEFORMATION IN GROOVED ROLLS. Henry A. Saller, John R. Keeler, and Lee J. Cuddy. Sept. 27, 1955. Decl. Jan. 8, 1960. 45p. Contract W-7405-eng-92. OTS.

The direction and extent of lateral deformation during the rolling of rod in grooved rolls was investigated. Composite uranium ingots and laminated ingots of colored modeling clay were used to investigate the deformation in diamond, oval-round, hand-round, and the FMPC breakdown rolls. X-ray-diffraction studies for preferred orientation were made on small areas of the cross section of uranium rod rolled in the standard FMPC schedule and on sections of rod rolled in diamond grooves. A tendency for the (002) planes to align parallel to the direction of lateral flow was observed in sections near the surface of the rod. At the center of the rod, no correlation was found between the direction of flow and the orientation. The coefficients of thermal expansion in two radial directions in a diamond-rolled rod were the same, although marked differences in the direction of lateral flow in these areas had been observed. (auth)

7742 BMI-1374

Battelle Memorial Inst., Columbus, Ohio.

GAS-PRESSURE BONDING OF ZIRCALOY-CLAD FLAT-PLATE URANIUM DIOXIDE FUEL ELEMENTS. Stan J. Paprocki, Edwin S. Hodge, Donald C. Carmichael, and Paul J. Gripshover. Aug. 28, 1959. 109p. Contract W-7405-eng-92. OTS.

A solid-state bonding technique involving the use of gas pressure at elevated temperatures was investigated for the preparation of compartmented Zircaloy-clad flat-plate uranium dioxide fuel elements. These investigations involved development of methods for the surface preparation and assembly of fuel-element components for bonding, determination of optimum bonding parameters, development of barrier coatings for uranium dioxide to prevent reaction with Zircaloy, and extensive testing and evaluation of the bonded fuel elements. During the course of this work, the process was continually modified and refined in an effort to improve the quality of the bonded element and decrease the cost of fabrication. The surface-preparation studies indicated that satisfactory bonding could be obtained consistently with both machined and belt-abraded components. Belt abrasion is more economical and was used as the standard technique in the development phases of the program. Initially the elements were assembled into a stainless steel or Ti-Namel envelope which was evacuated and sealed prior to bonding. Later studies showed that the quality of bonded elements could be improved and process costs decreased by edge welding the Zircaloy components to form a gastight assembly that was then bonded without use of a protective envelope. Further cost reductions were incorporated into the process by the use of piece Zircaloy components to form the picture frame. Optimum bonding with a minimum core-to-cladding reaction was achieved by pressure bonding at 1500 to 1550°F for 4 hr using a helium gas pressure of 10,000 psi. A postbonding heat treatment for 5 min at 1850°F in a salt bath promoted additional grain growth at the bond interface during the alpha-to-beta transformation. Barrier layers of graphite, chromium, iron, molybdenum, nickel, niobium, palladium, and various oxides were investigated to prevent reaction between the UO_2 core and Zircaloy cladding. Graphite, in the form of a sprayed and buffed coating, and chromium were found to be relatively effective barriers. The graphite coating was easy to apply and less expensive than a chromium electroplate. (auth)

7743 GEAP-3108(Pt. 1)

General Electric Co. Vallecitos Atomic Lab., Pleasanton, Calif.

THE FABRICATION OF THE FUEL ELEMENTS FOR THE UO_2 HIGH BURN-UP PROGRAM. E. A. Lees, M. E. Snyder, and R. N. Duncan. Jan. 12, 1959. 30p. Contract AT(04-3)-237. OTS.

The fuel rods for the 36 rod assemblies were fabricated by three methods: loose vibratory packing of the UO_2; loose vibratory packing followed by swaging of the UO_2; and pelletizing followed by sintering of the UO_2. The fuel component is clad with type 304 stainless steel with $\frac{1}{4}$-inch O.D. and about a 28 mil wall. Total length of the fuel rods is $36\frac{1}{4}$ inches. (W.L.H.)

7744 LR-14204

Lockheed Aircraft Corp., [Burbank, Calif.].

HIGH ENERGY RATE METAL FORMING. Interim Technical Engineering Report No. 7 [for] October 1 to December 31, 1959. A. F. Watts and Glen N. Rardin. 17p. ASC Project No. 7-588. Contract AF33(600)-35543.

The hoop stresses induced in the walls of a small water filled explosive forming tank with various insulating materials are presented. Air, as an energy absorbing medium, was found to be the most effective. (auth)

7745 NLCO-756

National Lead Co. of Ohio, Cincinnati.

DEVELOPMENT OF PASS SCHEDULE FOR ROLLING NARROW URANIUM STRIP. John F. Schiltz and John W. Magoun. June 19, 1958. Decl. Nov. 30, 1959. 23p. Contract AT(30-1)-1156. OTS.

Rolling schedules designed to reduce uranium billet sections to narrow flat plate were developed which comply with accepted surface quality and dimensional tolerances. (auth)

7746 RAE-TN-MET-281

Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.

EXPERIMENTS ON MELTING TITANIUM IN OXYGEN DEFICIENT THORIA CRUCIBLES. R. L. Bickerdike, G. Hughes, and D. Clark. Jan. 1958. 13p. (AD-159468).

Samples of titanium were heated in crucibles composed of $ThO_{1.5}$ at 1550 to 1770°C. After cooling, metallographic examination and hardness measurements were made and oxygen was determined. Titanium was melted in a commercial ThO_2 pot for comparison. A higher hardness, with more oxygen in solid solution resulted from melting in commercial thoria. Limitations of the $ThO_{1.5}$ material is discussed and it was concluded that it is unsatisfactory for use as a crucible. (J.R.D.)

7747

THE DESIGN OF SPECIAL HOODS FOR MACHINING NATURAL URANIUM METAL. STUDIES ON URANIUM FUEL ELEMENT. [PART] 4. K. Taketani (Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 1, 370-75(1959). (In Japanese)

Special hoods designed for machine tools, such as lathes, grinding cutters, and bench drills, are described. The hoods are well ventilated and are remotely controlled to minimize the necessity for opening the hood during operation. Uranium chips are filtered from the coolant by a specially designed vessel. Experiences and operating data are presented. (B.O.G.)

7748

CRYSTAL GROWTH OF CdS IN THE VERTICAL FURNACE. Haruo Fujisaki and Yasaku Tanabe (Tohoku Univ., Sendai). J. Phys. Soc. Japan 15, 204(1960) Jan.

The sublimation method was used to grow CdS crystals in a vertical furnace. The crystals were formed from condensation of the vapor phase of CdS powder. They were of mosaic structure having boundaries formed by several single crystals. The surface structures are influenced by temperature, temperature gradient of growth location, and the cooling rate of the furnace. These results indicate that large single crystals of CdS may be obtained at a shorter time interval by heat treatment in the furnace and that the behavior of layer growth plays an important role in the mechanism of crystal growth. (B.O.G.)

7749

HEAT TREATING ELECTROLESS NICKEL COATINGS. K. T. Ziehlke, W. S. Dritt, and C. H. Mahoney (Oak Ridge Gaseous Diffusion Plant, Tenn.). Metal Progr. 77, No. 2, 84-7(1960) Feb.

Heat treatment of electroless nickel coatings, chemically deposited nickel and phosphorus (7 to 10.5%), produced no microstructure changes below 750°F. Above 750°F, precipitation and agglomeration were detected. The maximum hardness (1000 dph) was found to be independent of phosphorus content and occurred during the formation of an interim lattice from the amorphous structure of the as-deposited plate. (C.J.G.)

7750

HIGH-TEMPERATURE BRAZING EXPERIMENTS. R. R. Ruppender (General Electric Co., Cincinnati). Metal Progr. 77, No. 2, 5-7(1960) Feb.

Statistical analysis is suggested as a means of resolving discrepancies in results of similar fusion welding experiments. Details of a typical experiment illustrate the possibilities. (auth)

7751

A NONDESTRUCTIVE METHOD TO DETECT PIPES AND CAVITIES IN HOT STEEL BLOOMS DURING THE ROLLING-PROCESS BY MEANS OF BETATRON, X-RAY-IMAGE-INTENSIFIER AND TELEVISION-SETUP. Werner Lueckerath, Kurt Fink, and Ronald Flossmann (Phoenix-Rheirohr AG, Dusseldorf, Ger.). Nondestructive Testing 18, 27-34(1960) Jan.-Feb.

A method is described permitting immediate detectability of pipes in hot 4 to 12 inches square blooms under continuous rolling-mill conditions. A 31-Mev-betatron is used as radiation source. The radiation image is viewed by an x-ray image intensifier having an effective primary screen diameter of 8.7 inches and of a highly sensitive image orthicon television equipment. In the range of 4 to 8 inches steel, the German Industrial Norm-wire-penetrameter sensitivity is 2.3%. Pipes with a width of 0.125 inch in the direction of the x-ray beam, corresponding to a pipe sensitivity of 1.5%, related to the steel thickness penetrated by the x rays, are made visible in travelling blooms. It is impossible to distinguish between slag-containing and slag-free shrinkage cavities. The maximum bloom speed allowable for viewing the radiation image is 40 feet/min. More than 1000 blooms 8.4 and 9.5 inches square can be tested under mill operating conditions. The possibilities which the radiation equipment offers for the study of pipe formation in relation to the casting and freezing conditions for various steel types are reviewed. (auth)

7752

OMR FLAT PLATE FUEL ELEMENT FABRICATION. G. V. Alm, E. E. Garrett, and M. H. Binstock (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 7, 73-82(1960) Jan.

The methods used for fabrication of finned aluminum-clad flat plate fuel elements are discussed. Uranium–

3.5 wt.% Molybdenum alloy core plates were fabricated by vacuum casting in graphite molds. The uranium alloy plate was electroplated with nickel and inserted into an extruded aluminum sheath containing external fins. Aluminum end plugs were inserted to complete the fuel plate assembly. A core-to-cladding metallurgical bond was obtained by hot gas pressing (isostatic pressing) the assembly. Bonded plates were end machined, inspected, stacked, clipped, and loaded into a stainless steel container box. Cast stainless steel end hardware was then affixed by heliarc welding to the respective box ends to result in the completed fuel element. Methods for process control are discussed. Preliminary irradiation results are presented which indicate that the elements produced by the described process are suitable for organic moderated reactor use. (auth)

7753

PREPARATION OF THIN TARGETS FROM POWDERS. George Fodor and Bernard L. Cohen (Univ. of Pittsburgh). Rev. Sci. Instr. 31, 73-4(1960) Jan.

Two methods used in the preparation of thin targets from materials available only in powder form were compared with a recently developed method which retains the advantages of both without the disadvantages of either. The newer method consists of depositing a suspension of the powder in polystyrene on a roughened thin Mylar foil. The resulting foil is extremely rugged, is very uniform, can be easily made of any desired thickness above 1 mg/cm^2, and requires only about 15 min to prepare. Foils of thicknesses 1 to 10 mg/cm^2 were bombarded by 15-Mev deuteron beams of about 0.5 μa/cm^2. (B.O.G.)

7754

METHOD OF COATING GRAPHITE WITH STABLE METAL CARBIDES AND NITRIDES. D. H. Gurinsky (to U. S. Atomic Energy Commission). U. S. Patent 2,910,379. Oct. 27, 1959.

A method is presented for forming protective stable nitride and carbide compounds on the surface of graphite. This is accomplished by contacting the graphite surface with a fused heavy liquid metal such as bismuth or lead-bismuth containing zirconium, titanium, and hafnium dissolved or finely dispersed therein to form a carbide and nitride of at least one of the dissolved metals on the graphite surface.

7755

METHOD FOR SOLDERING NORMALLY NON-SOLDERABLE ARTICLES. J. C. McGuire (to U. S. Atomic Energy Commission). U. S. Patent 2,914,425. Nov. 24, 1959.

Methods are presented for coating and joining materials which are considered difficult to solder by utilizing an abrasive wheel and applying a bar of a suitable coating material, such as Wood's metal, to the rotating wheel to fill the cavities of the abrasive wheel and load the wheel with the coating material. The surface of the base material is then rubbed against the loaded rotating wheel, thereby coating the surface with the soft coating metal. The coating is a cohesive bonded layer and holds the base metal as tenaciously as a solder holds to easily solderable metals.

7756

SOLID STATE BONDING OF THORIUM WITH ALUMINUM. S. Storchheim (to U. S. Atomic Energy Commission). U. S. Atomic Energy Commission). U. S. Patent 2,914,847. Dec. 1, 1959.

A method is described for bonding thorium and aluminum by placing clean surfaces of thorium and aluminum in contact with each other and hot pressing the metals together in a protective atmosphere at a temperature of about 375 to 575°C and at a pressure of at least 10 tsi to effect a bond.

7757

FABRICATION OF URANIUM–ALUMINUM ALLOYS. H. A. Saller (to U. S. Atomic Energy Commission). U. S. Patent 2,917,383. Dec. 15, 1959.

A process is presented for producing a workable article of a uranium–aluminum alloy in which the uranium content is between 14 and 70% by weight; aluminum powder and powdered UAl_2, UAl_3, UAl_5, or UBe_9 are mixed, and the mixture is compressed into the shape desired and sintered at between 450 and 600°C.

Properties and Structure

7758 AD-219924

Cincinnati. Univ. Research Foundation.

ELEVATED TEMPERATURE PHASE RELATIONSHIP OF THE TERNARY SYSTEM Ti–Zr–O. Quarterly Report for February 1, 1959–May 1, 1959. Michael Hoch. June 24, 1959. 6p. Project No. 7-(8-7350). Contract AF33(616)-3881.

Univariant equilibria points in the O–Ti–Zr system are reported. A single-phase region connecting cubic ZrO_2 with $TiZrO_4$ is reported at 1500°C. (C.J.G.)

7759 AECU-4629

Los Alamos Scientific Lab., N. Mex.

REVIEW OF THE INTERMETALLIC COMPOUNDS OF PLUTONIUM. F. H. Ellinger. [1959]. 49p. OTS.

Crystallographic data on intermetallic plutonium compounds are presented. The compounds are described in alphabetical order of the alloying component. A table is included in which all of the plutonium compounds and isotopes mentioned in the report are listed along with the corresponding references. (J.R.D.)

7760 AFOSR-TR-59-126

Birmingham. Univ., England.

THE BEHAVIOUR OF GRAIN BOUNDARIES IN METALS IN A TEMPERATURE GRADIENT. Final Technical Summary Report [for] October 1956–October 1959. R. W. Cahn and R. W. Lucas. 45p. Contract AF61(514)-1020.

The grain-boundary migration in metals induced by temperature gradients was investigated. Preliminary experiments were carried out with zinc polycrystals, zinc bicrystals, zone-refined zinc, and aluminum bicrystals. It was found that grain-boundary motion induced by a temperature gradient can not take place in a metal of high purity. Grain-boundary motion can occur when appropriate solutes are concentrated at the grain boundary. The driving force for migration is small and surface tension forces tending to contract a curved boundary readily mask the effect in zinc. (J.R.D.)

7761 BMI-1322

Battelle Memorial Inst., Columbus, Ohio.

THE EFFECT OF FABRICATION VARIABLES ON THE STRUCTURE AND PROPERTIES OF UO_2–STAINLESS STEEL DISPERSION FUEL PLATES. Stan J. Paprocki, Donald L. Keller, and George W. Cunningham. Feb. 18, 1959. Decl. Dec. 3, 1959. 76p. Contract W-7405-eng-92. OTS.

Based on the results of detailed fabrication studies, an evaluation of the effects of varying the type and size of UO_2 particles, the type and size of stainless steel matrix powders, blending procedures, compacting pressures, sintering times, temperatures, and atmospheres, roll-cladding

temperatures and reduction rates, total cold reduction, and heat-treating times and temperatures was made for UO_2-stainless steel dispersion fuel elements. Transverse tensile tests, creep-rupture tests, metallographic examination, radiography, density measurements, and x-ray-diffraction studies were used to evaluate the structure and properties of the fuel elements. From these studies a reference fabrication procedure for GCRE fuel elements was established. The fuel element core contains minus 100 plus 200-mesh hydrothermal UO_2 dispersed in an 18-14-2.5 alloy matrix prepared from minus 325-mesh elemental iron, chromium, nickel, and molybdenum powders. Commercial Type 318 stainless steel is used for cladding. Core compacts are sintered in steps to 2300°F after cold compacting at 15 tsi. Evacuated picture-frame packs are hot rolled from a hydrogen muffle at 2200°F with a 40% reduction in thickness on the first pass and a 20% reduction in thickness on remaining passes. After annealing at 2300°F, the fuel elements are given a light pickle and cold reduced 15 to 20% in thickness to give a total reduction of 8 to 1. The final treatment consists of a flat anneal at 2050°F. (auth)

7762 CEA-1057

France. Commissariat à l'Énergie Atomique, Paris.

INFLUENCE DES TRAITEMENTS THERMIQUES EN PHASES β ET γ SUR LA STRUCTURE MICROGRAPHIQUE DE L'URANIUM. (Influence of Heat Treatment in β and γ Phases on the Microscopic Structure of Uranium). André Robillard. 1959. 43p.

Thesis submitted to the Univ. of Paris.

A new method of microscopic examination of uranium is described. Electrolytic polishing and etching are carried out in an acetic acid–chromic acid bath. Atmospheric or anodic oxidation of the polished surface produces films which follow exactly changes in the structure of the underlying metal. This method is very sensitive to small variations of orientation in polygonized crystals. Using this method of examination of uranium, it was found that annealing U in the γ phase followed by a cooling at a rate dependent of the annealing temperature, causes the formation of substructures different from those due to the polygonization of α–U. The substructures are indicated by the concentration of impurities on the dislocations induced by the stresses accompanying the allotropic transformation $\gamma \rightarrow \beta$. Similar treatment of the U–1.4% Cr alloy in which the β phase is stabilized at room temperature, confirms this explanation. In addition to the polygonization substructures, sharp discontinuities can be observed in the network of sub-boundaries as a fine white edging. The comparison of these with the structure revealed by thermal etching in vacuo suggest that there are traces of the grain boundaries of the γ phase. The method of etching followed by oxidation shows a haloed phase identified as UH_3. The conditions of appearance and disappearance of this phase are studied. The sensitivity of this method of detecting the last traces of H in U is very high. The dependence of the hydrogen content on the tensile properties of uranium metal was also studied. (auth)

7763 HW-31676

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

SOME EFFECTS OF STRIATIONS ON SLUG QUALITY. R. L. Knecht and J. W. Goffard. Apr. 30, 1954. Decl. Jan. 29, 1960. 8p. Contract [W-31-109-Eng-52]. OTS.

Results of an investigation to determine the effects of striation content on slug core properties are described. Striations were found to lower the bursting strength of slugs which had been machined hollow and to decrease the number of thermal cycles necessary to produce mechanical failure in slug cores. Increasing slug striations are closely related to decreasing slug density and reactivity. A canned quality evaluation summary is given. (J.R.D.)

7764 HW-40312

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FLOW STRESS RECOVERY OF ZIRCALOY-2. Dale E. Johnson. Dec. 7, 1955. Decl. Jan. 8, 1960. 18p. OTS.

The effect of prolonged heating of cold-worked Zircaloy-2 at a temperature of 360°C on the mechanical properties of the material was investigated. Coupons from sheets which had been cold rolled to 25, 50, and 65% cold-worked conditions were used. The atmosphere in the quartz ampules was commercial purity He at a pressure of 20 cm of Hg. (W.D.M.)

7765 NP-8258

Columbia Univ., New York. Stanley Thompson Labs.

EFFECT OF SURFACE ACTIVE AGENTS ON THE STRENGTH PROPERTIES OF METALS. Leonard Nanis. Dec. 4, 1959. 37p. Contract Nonr-266(64).

A survey of U.S., British, Russian, and German literature was conducted to obtain information on the Rebinder effects. American and British literature reveals that no effects are found for polycrystalline wires, although creep enhancement is observed on single crystals. Russian and German schools find creep enhancement for polycrystalline wires, presumably by a lowering of metal surface energy. Experiments were conducted to check information gained from the literature survey. Specimens of 99.999% Cu were used. No significant difference between coated and uncoated wire properties was observed. (J.R.D.)

7766 ORO-236

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

MONTHLY LETTER REPORT NO. 11 COVERING PERIOD SEPTEMBER 15 TO OCTOBER 15, 1959. J. D. Fleming. Oct. 22, 1959. 2p. Contract AT(40-1)-2483. OTS.

Firings were begun on D tensile test slip cast silicon specimens. An average strength of 1960 psi is reported on 15 silicon specimens dried and fired at 2200°F for four hours. An elevated temperature testing furnace using silica as the shell and foam silica for insulation was completed. Studies to determine the effects of soaking techniques intended to seal porous silica on strength of the material were continued. Silicon devitrification studies using x-ray diffraction were partially completed, and analysis of results begun. (For preceding period see M-7305.) (J.R.D.)

7767 SCNC-294

Sylvania-Corning Nuclear Corp., Bayside, N. Y.

HIGH CONDUCTIVITY UO_2. Terminal Report. H. Shapiro and R. M. Powers. Oct. 1959. 43p. Contract AT-30-1-GEN-366. OTS.

A program to improve the thermal conductivity of UO_2 by the addition of small quantities of other oxides is described. CeO_2, Y_2O_3, and Nb_2O_5 were studied in $\frac{1}{4}$, 1, and 4 mole % additions, respectively. Thermal conductivity measurements indicated that Y_2O_3 additions cause an increase in the thermal conductivity at 1 and 4 mole % addition levels. Electrical resistance measurements indicated a lower resistance as increasing amounts of Y_2O_3 are added. UO_2 plus $\frac{1}{4}$ mole % Nb_2O_5 had lower thermal conductivity and higher electrical resistance than UO_2. Tests indicated that, with the exception of Nb_2O_5, minor amounts of these additives in solid solution have little effect on UO_2 corrosion. (J.R.D.)

7768 WAL-TR-143/34
Watertown Arsenal Lab., Mass.
ULTRASONIC DETERMINATION OF ELASTIC CONSTANTS OF METALS AT ELEVATED TEMPERATURES. A. P. Levitt and A. G. Martin. Sept. 1959. 15p. DA Project No. 5B93-32-004.

An ultrasonic pulse-echo technique was developed for measuring the dynamic elastic constants of metals at elevated temperatures. This technique and the test system developed for using it are described. The theory of ultrasonic wave propagation in polycrystalline solids, including the expressions used to calculate the elastic constants from the measured wave velocities are presented. The design criteria and the methods for meeting them in the development of the test system are also discussed. (auth)

7769 WAL-TR-834.2/1
Watertown Arsenal Lab., Mass.
LOW TEMPERATURE PLASTIC FLOW AND FRACTURE TENSION PROPERTIES OF HEAT-TREATED SAE 4340 STEEL. Frank R. Larson and John Nunes. Dec. 1959. 56p. DA Project No. 5B93-32-002. OTS.

True stress-true strain tension properties of a heat-treated SAE 4340 steel were obtained at a testing speed of 0.01-inch per minute at 200° to −196°C. A variety of microstructures, martensite, bainite, and pearlite, were studied at several strength levels. The flow stress, strain hardening, fracture stress, and fracture strain were determined. (auth)

7770 AEC-tr-3950
POLARIZATION OF THE NUCLEI OF DIAMAGNETIC ELEMENTS DISSOLVED IN IRON. B. N. Samoilov, V. V. Sklyarevskii, and E. P. Stepanov. Translated by A. L. Monks (Oak Ridge National Lab.) from a publication of the Lenin Institute of Atomic Energy, Akad. Nauk., 1959. 39p. (Includes original, 24p.) JCL or LC.

The possibility of polarizing nuclei of diamagnetic elements (indium, antimony, and gold) in weak iron solutions of these elements has been established. Samples of the ferromagnetic melts In–Fe, Sb–Fe, and Au–Fe were cooled to ~0.03°K and magnetized to saturation by a weak (~2000 oersteds) magnetic field. The anisotropy of the γ irradiation of In^{114m}, Sb^{122}, and Au^{198} nuclei contained in the samples was measured. It was found that a strong internal magnetic field (for which the following limits could be found, In $H > 2.5 \times 10^5$, Sb $H > 2.8 \times 10^5$, Au $H > 1.0 \times 10^6$) acted on the nuclei of the elements dissolved in the iron. The hypothesis is advanced that this field is created by the conductivity electrons which possess a considerable degree of polarization in the ferromagnet. At a temperature of 0.03°K the polarization of the investigated nuclei is not less than 30 to 50%. (auth)

7771 AERE-Trans-11/2/5/265
DIFFUSION IN SOLID METALS. W. Seith and A. Kottmann. Translated for U.K.A.E.A. Atomic Energy Research Establishment from Angew. Chem. 64, 379-91(1952). 44p.

The relationship between the partial diffusion coefficients determined by radioactive means and the partial chemical diffusion coefficients calculated from marker shifts in diffusion bodies is described and experimentally checked. Variations in shape and dimension and the occurrence of cavities caused by the process of diffusion are investigated in the systems Ni–Cu, Ag–Au, Ni–Au, Ag–Pd, and Fe–Ni. The mass flow is studied in connection with gap formation and reconstruction of matter in the diffusion specimen. In an appendix to the experimental findings, the problems of the mechanism of diffusion in metallic mixed crystals are discussed. (auth)

7772
INTERMETALLIC REACTIONS AND AGEING EFFECTS IN THIN FILMS. C. Weaver and R. M. Hill (Royal Coll. of Science and Tech., Glasgow). Advances in Phys. 8, 375-437(1959) Oct.

Preparation of alloy films by evaporation is described. The theory of diffusion in films of single and multi-phase systems is discussed in conjunction with the effect of film structure on diffusion. Electron diffraction methods used in the investigation of the binary systems Ag–Al, Al–Cu, Au–Cu, and In–Sb are presented. The electric resistivity of the binary systems was measured at various temperatures and times. Age-hardening tests were conducted using Al, Cu, and Au films with Chromel, Cr, Co, Fe, Pb, Mn, and Ni as the base element. Results are summarized for binary systems investigated. (B.O.G.)

7773
THE GROWTH OF URANIUM RODS IN CORROSIVE GAS. I. V. Batenin, A. N. Rudenko, and B. V. Sharov. Atomnaya Energ 7, 329-32(1959) Oct. (In Russian)

Studies were made of the elongation of hot uranium specimens aged in air, nitrogen, and carbon dioxide. The elongation dependence on temperature, pressure, rod diameter, and preliminary surface oxidation was determined. The elongation of copper wire was also analyzed. A possible explanation of the elongation mechanism is offered. (tr-auth)

7774
TEMPERATURES, THERMAL STRESSES AND DISPLACEMENTS IN SOLID URANIUM DIOXIDE RODS. J. P. Ellington (United Kingdom Atomic Energy Authority, Risley, Lancs, Eng.). Brit. J. Appl. Phys. 11, 33-5(1960) Jan.

Expressions are derived for the temperatures, stresses, and displacements in a solid uranium dioxide fuel rod, the thermal conductivity of which decreases exponentially with temperature. Graphs of the temperatures and displacements are given, and calculation shows that the rod will fracture when the center-to-surface temperature drop exceeds 80 to 90°C. (auth)

7775
EFFECT OF PRESSURE ON THE INTERMETALLIC COMPOUND FORMED BY DIFFUSION BETWEEN URANIUM AND COPPER. Yves Adda, Michel Beyeler, and Alexis Kirianenko. Compt. rend. 250, 115-17(1960) Jan. 4. (In French)

Significant variations were demonstrated in the chemical composition and crystalline parameters of the intermetallic compound formed by diffusion between U and Cu without external pressure. These variations were found to be suppressed by application of hydrostatic or uniaxial pressure greater than 500 kg/cm^2 during the diffusion treatment. (tr-auth)

7776
PENETRATION OF HYDROGEN INTO METALS AND ESPECIALLY INTO IRON. Ahmad Banège-Nia. Compt. rend. 250, 524-6(1960) Jan. 18. (In French)

The methods of study of H penetration into metals are reviewed, and the present state of affairs in research on the subject is summarized. (T.R.H.)

7777
STUDY OF URANIUM–STRONTIUM DIFFUSION BY EXPERIMENTS ON A HETEROGENEOUS SYSTEM. Yves Adda, Viviane Lévy, Zeev Hadari, and Jean Tournier. Compt. rend. 250, 536-8(1960) Jan. 18. (In French)

It is shown that micrographic study of the dissolution of

Sr-rich precipitates in heterogeneous Sr–U alloys can lead to a simple, precise method of determination of the diffusion coefficient of Sr in U. (tr-auth)

7778

SPECIFIC HEAT OF URANIUM–MOLYBDENUM IN γ PHASE BETWEEN 1 AND 4°K. Bruce Bailey Goodman, Jacques Hillairet, Jean-Jacques Veyssié, and Louis Weil (Institut Fourier, Grenoble, France). Compt. rend. 250, 542-4(1960) Jan. 18. (In French)

The transition temperature, the Debye temperature of the lattice, and the coefficient of electronic specific heat of U–Mo alloys vary with composition in a manner conforming to the superconductivity theory. The variation of the density of states at the Fermi level is compared with that deduced from recent measurements of the resistivity of these alloys. (tr-auth)

7779

CERTAIN PROPERTIES OF ALLOYS OF THE SYSTEM InAs–In_2Se_3. L. I. Berger and N. N. Sirota (Kalinin Inst. of Non-Ferrous Metals and Gold, Moscow and Division of Solid-State Physics and Semiconductors, Minsk). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. No. 11, 102-5(1959) Nov. (In Russian)

The measurements of thermal conductivities and thermal expansion coefficients of InAs–In_2Se_3 alloys are presented. In the system InAs–In_2Se_3, solid solutions form in a wide concentration interval. The thermal conductivity falls more quickly than the electrical conductivity with the growth of concentration of In_2Se_3. A correlation between thermal conductivities and thermal expansion coefficients in the temperature interval investigated is found in the form $1/x \sim \alpha^2$. (auth)

7780

HIGH-TEMPERATURE X-RAY DIFFRACTION INVESTIGATION OF THE URANIUM–CARBON SYSTEM. W. B. Wilson (Battelle Memorial Inst., Columbus, Ohio). J. Am. Ceram. Soc. 43, 77-81(1960) Feb.

The system UC–UC_2 was investigated at temperatures to 2200°C utilizing high-temperature x-ray-diffraction techniques. UC_2, which has the CaC_2 structure, was shown to transform to the CaF_2 structure at 1820°C. Mean coefficients of expansion of UC, U_2C_3, and UC_2 were determined. The decomposition of U_2C_3 to cubic UC_2 and to UC saturated metastably with carbon was observed. Solubilities of UC in UC_2 and UC_2 in UC were determined near 1800°C by a method based on lattice-parameter measurements. The formation of, and existence conditions for, U_2C_3 were confirmed. It was observed that UC_2 tends to decompose toward UC at the extreme temperatures, probably by loss of carbon to CO. (auth)

7781

PEROVSKITE-TYPE COMPOUNDS IN BINARY RARE EARTH OXIDE SYSTEMS. S. J. Schneider and R. S. Roth (National Bureau of Standards, Washington, D. C.). J. Am. Ceram. Soc. 43, 115(1960) Feb.

The results pertaining to perovskite-type compounds found in double oxides of the trivalent rare earth ions are presented. A survey of the subsolidus reactions that occur in various binary rare earth oxide systems has definitely established the existence of stable perovskite-type compounds. The results show that perovskite-type compounds are formed in the following four binaries: La_2O_3–Er_2O_3; La_2O_3–Tm_2O_3; La_2O_3–Yb_2O_3; and La_2O_3–Lu_2O_3. Specimens were prepared from equimolar mixtures of the trivalent rare earth oxides and examined at room temperature by x-ray-diffraction methods. (B.O.G.)

7782

TORSION INDUCED RECRYSTALLIZATION OF MOLYBDENUM AND TUNGSTEN FILAMENTS. F. E. Gifford and E. A. Coomes (Univ. of Notre Dame, Ind.). J. Appl. Phys. 31, 235-7(1960) Feb.

When an optimum amount of permanent twist is introduced in 3- to 10-mil filaments of molybdenum or tungsten, single crystals up to 15 cm in length grow by either the moving gradient or Robinson techniques. About 5 turns per inch for W at 2500°K or for Mo at 1650°K was favorable. Although there is evidence of perfection in the volume of the crystals, the twist leaves a threadlike surface imperfection which remains even after severe heat treatment at evaporation temperatures. (auth)

7783

EFFECT OF ELECTRON IRRADIATION AND SUBSEQUENT THERMAL TREATMENT ON YOUNG'S MODULUS OF COPPER. A. Sosin and L. L. Bienvenue (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). J. Appl. Phys. 31, 249-52(1960) Feb.

Measurements of Young's modulus of copper following high energy electron irradiation and subsequent heat treatment are reported. The modulus is observed to increase following short exposures at −190°C in three separate temperature regions, centered at approximately −45°C, −5°C, and +80°C. These modulus increases are discussed in terms of the various point defects created by the bombarding electrons. (auth)

7784

GROWTH, STRUCTURE, AND PROPERTIES OF GRAPHITE WHISKERS. Roger Bacon (National Carbon Co., Cleveland). J. Appl. Phys. 31, 283-90(1960) Feb.

Graphite whiskers were grown in a d-c arc under a pressure of 92 atmospheres of argon and at 3900°K. They are embedded in a solid matrix of graphite which builds up by diffusion of carbon vapor from the positive to the negative electrode. Diameters range from a fraction of a micron to over five microns, with recoverable lengths up to 3 cm. They consist of one or more concentric tubes, each tube being in the form of a scroll, or rolled-up sheet of graphite layers, extending continuously along the length of the whisker, with the c axis exactly perpendicular to the whisker axis. They exhibit a high degree of flexibility, tensile strengths up to 2000 kg-mm^{-2}, Young's modulus in excess of 7×10^{12} dyne-cm^{-2}, and values of room-temperature resistivity of around 65 μohm-cm, which approximates the single crystal value. (auth)

7785

METHOD FOR THE DETECTION OF FLAWS IN YTTRIUM IRON GARNET CRYSTALS. E. Buehler and M. Tanenbaum (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 31, 388-90(1960) Feb.

Infrared techniques similar to those used in examining silicon crystals were applied to the examination of yttrium iron garnet crystals. Photographic results for both flux grown and sintered crystals are given. (auth)

7786

DETERMINATION OF ATOMIC DISTRIBUTIONS IN LIQUID LEAD–BISMUTH ALLOYS BY NEUTRON AND X-RAY DIFFRACTION. Paul C. Sharrah, John I. Petz, and Robert F. Kruh (Univ. of Arkansas, Fayetteville). J. Chem. Phys. 32, 241-6(1960) Jan.

The intensity of scattered neutrons and x rays was measured for molten alloys and pure components in the system lead-bismuth. A specially designed diffraction spectrometer was constructed for the x-ray determinations. The

diffraction data were treated to give atom distributions, and the first main peak in the distribution curves for solutions up to about 60 wt.% bismuth corresponds to 12 nearest neighbors, with the value falling to about 7.7 for pure bismuth. No unusual features were found in the eutectic region, but the density decrease on melting of lead-rich solids is puzzling in view of the retention of 12 nearest neighbors at a mean distance shorter than in the crystal. A model of average pentagonal dodecahedral coordination is suggested to account for this and for the spacing of first maxima in the distribution curves. (auth)

7787

THE VARIATION WITH TEMPERATURE OF YOUNG'S MODULUS FOR SOME URANIUM ALLOYS AND FOR THORIUM, VANADIUM, AND NIOBIUM. D. J. Livesey (United Kingdom Atomic Energy Authority, Sellafield, Cumb., Eng.). J. Inst. Metals 88, 144(1959) Nov.

The decreasing values of Young's modulus at 20 to 500°C were measured for niobium, thorium, vanadium, uranium, and uranium alloys by a dynamic method similar to the method of Entwistle. (C.J.G.)

7788

THE CONSTITUTION OF MANGANESE BASE ALLOYS WITH METALS OF THE SECOND TRANSITION SERIES. A. Hellawell (Oxford Univ.). J. Less-Common Metals 1, 343-7(1959). (In English)

Binary phase diagrams were determined for manganese base alloys with the metals yttrium, zirconium, niobium, molybdenum, ruthenium, rhodium, palladium, and silver. The results were based principally on thermal analysis, supplemented by microscopical examination. (auth)

7789

SOME MEASUREMENTS ON THE THERMOELECTRIC POWER OF PLUTONIUM METAL. J. A. Lee and R. O. A. Hall (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Less-Common Metals 1, 356-61(1959). (In English)

The thermal e.m.f. of a plutonium–platinum thermocouple was measured between 20 and 630°C. The absolute thermoelectric power of plutonium in its six allotropic modifications was calculated over the stable temperature range. The implications of the results in relation to the form of the density of states/energy curve at the Fermi surface are discussed. (auth)

7790

A SURVEY OF THE RHENIUM–CARBON SYSTEM. J. E. Hughes (Associated Electrical Industries, Aldermaston, Berks, Eng.). J. Less-Common Metals 1, 377-81(1959). (In English)

Alloys of rhenium and carbon form a simple eutectic system at 16.9 at. % carbon at 2480°C. The solid solubility of carbon in rhenium is 11.7 at. % at the eutectic temperature, falling to 4.2 at. % at 1800°C. No rhenium carbide was detected in the system. (auth)

7791

AN INTERPRETATION OF SOME OF THE PROPERTIES OF THE TRANSITION METALS AND THEIR ALLOYS. D. A. Robins (Tin Research Inst., Greenford, Middx., Eng.). J. Less-Common Metals 1, 396-410(1959). (In English)

The hypothesis is put forward that many of the properties of the transition metals can be interpreted in terms of a relationship between the co-ordination number of the metal atoms and the number of bonding electrons per atom. The electron resonance contribution to the bond strength is a maximum when the number of bonding electrons per atom is approximately equal to half the effective co-ordination number and it is postulated that the stability of this arrangement dictates very largely the alloying behavior and crystal structure. The alloying behavior of transition metals and their interaction with hydrogen and other interstitial elements are considered in relation to the hypothesis. (auth)

7792

LOSS OF METAL FROM CHROMIUM AT ELEVATED TEMPERATURES IN AIR. G. R. Wilms and T. W. Rea (Defence Standards Labs., Maribyrnong, Victoria, Australia). J. Less-Common Metals 1, 411-12(1959). (In English)

Chromium samples were heated in air at constant temperatures of 1000 to 1100°C for 200 hours. The loss in weight of the samples increased with increase in furnace size. This is considered to be due to the proportional increase in convective air flow in the larger furnace. (C.J.G.)

7793

THE EFFECT OF OXYGEN, CARBON AND NITROGEN ON THE PROPERTIES OF SINTERED THORIUM. M. D. Smith and R. W. K. Honeycombe (Univ. of Sheffield, Eng.). J. Nuclear Materials 1, 345-55(1959) Dec. (In English)

A study was made of the mechanical properties and microstructures of alloys of thorium with oxygen, nitrogen, and carbon prepared by sintering followed by cold working and annealing. It is shown that the properties obtained are comparable, and in some cases superior to those obtained from arc-melted alloys. Unlike oxygen and nitrogen, small concentrations of carbon increase the strength of thorium markedly. A determination of the solid solubility of carbon in thorium enabled a closer correlation of the observed strengthening with carbon solubility to be made. Metallographic observations were made on the occurrence of thoria, thorium nitride, and thorium carbide in the various alloys. (auth)

7794

STABILIZATION OF THE γ-PHASE IN TERNARY ALLOYS WITH MOLYBDENUM–URANIUM BASE. G. Cabane and G. Donzé (Centre d'Études Nucléaires, Saclay, France). J. Nuclear Materials 1, 364-73(1959) Dec. (In French)

The stability of the γ-phase in uranium-molybdenum alloys was found to be increased by a ternary addition. The effects of chromium, niobium, rhenium, ruthenium, and zirconium were studied. The molybdenum content was progressively reduced so as to maintain a constant atomic concentration of solute; the alloys fall into three groups containing, respectively, 14, 16, and 18 at.% of solute. Only zirconium reduced the stability of the γ-phase, and it is also the only one among the solutes listed which has a larger atomic radius than uranium. It appears that the metastability of the γ-phase in the $\alpha + \gamma'$ field arises primarily from the contraction of the cubic lattice through the substitution of small atoms. In the concentration range investigated, it appears that there is for each favorable ternary solute an optimum concentration, beyond which the stability does not increase further or else tends to return towards the value characteristic of the binary Mø-U alloy. The stabilizing capacity of the addition elements is relatively greater as the total concentration of addition elements is smaller. The comparison of the different alloys from the point of view of reactivity was made. For a given loss of reactivity the replacement of molybdenum by ruthenium allowed the period of incubation to be increased by a factor of 5. (auth)

7795
X-RAY MEASUREMENT OF THERMAL EXPANSION PERPENDICULAR TO THE LAYER PLANES OF ARTIFICIAL AND NATURAL GRAPHITES. E. G. Steward and B. P. Cook (General Electric Co., Ltd., Wembley, Eng.). Nature 185, 78-80(1960) Jan. 9.

Preliminary results are reported from x-ray measurements of the thermal expansion perpendicular to the layer planes of artificial and natural graphites. (C.H.)

7796
STEELS FOR NUCLEAR REACTORS. H. F. Beeghly (Jones & Laughlin Steel Corp., Pittsburgh). Nuclear Sci. and Eng. 7, 21-5(1960) Jan.

In building a nuclear reactor of any type, the stage is reached at which a decision must be made as to what steels can be used in construction of each plant component. Nuclear engineers have recognized the limitations of some of the common steels in nuclear environments and are pointing out ways the steelmaker should go in devising steels with the nuclear and chemical properties more compatible with them. Methods of fabrication, mechanical property data, and compositions of carbon and alloy, including low manganese, low residual element steels made for possible nuclear uses are summarized and compared with those of standard grades of carbon and alloy steels. The limitations on composition imposed by nuclear considerations, and selected data on experimental and commercially produced steels made to avoid these limitations, are outlined. Low manganese steels are commercially available; should the need arise, other compositions both carbon and alloy that are now experimental could be made. (auth)

7797
PERMEATION OF HYDROGEN THROUGH METALS. R. Ash and R. M. Barrer (Imperial Coll., London). Phil. Mag. (8) 4, 1197-1206(1959) Nov.

The theory of permeation of hydrogen through certain transition metals was further developed. It was shown that this theory, in which certain slow phase-boundary processes couple with diffusion to produce the permeation phenomena, can in rather simple ways predict the observed behavior. In particular, "threshold pressures" for permeation can be understood; and also permeation velocities which depend on the ingoing pressure, p_1, according to p_1^n where $0 \leq n \leq 1$, and upon membrane thickness l according to l^m where $-1 \leq m \leq 0$. (auth)

7798
ACCURATE DETERMINATION OF THE LATTICE PARAMETERS OF BERYLLIUM. D. R. Schwarzenberger (Tube Investments Research Labs., Cambridge, Eng.). Phil. Mag. (8) 4, 1242-6(1959) Nov.

The lattice parameters of a single crystal of beryllium were determined from observations on a divergent-beam transmission x-ray photograph of the crystal. Diffraction in the crystal leads to a pattern of deficiency lines on a photographic plate, the geometry of which is determined by the lattice parameters of the crystal, and the wavelength of the radiation, but is independent of the exact experimental arrangement. The values obtained are: a = 2.2866 ± 0.0006 Å; c = 3.5833 ± 0.0009 Å; and c/a = 1.5671. (auth)

7799
SOME PHYSICAL PROPERTIES OF NEPTUNIUM METAL. II. A STUDY OF THE ALLOTROPIC TRANSFORMATIONS IN NEPTUNIUM. J. A. Lee, P. G. Mardon, J. H. Pearce, and R. O. A. Hall (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. and Chem. Solids 11, 177-81 (1959) Oct.

The phase transformations in neptunium metal were studied by thermal analysis, dilatometry, and resistivity measurements. The values obtained were: $\alpha \rightarrow \beta$ 280 ± 5°C, $\beta \rightarrow \gamma$ 577 ± 3°C, and $\gamma \rightarrow$ liquid 637 ± 2°C. Results of the x-ray examination of the crystal structures of the three phases are compared with those of Zachariasen (Acta Cryst. 5, 660, 664(1952)). (auth)

7800
SOME PHYSICAL PROPERTIES OF NEPTUNIUM METAL. III. THE ELECTRICAL RESISTIVITY AND THERMOELECTRIC POWER OF NEPTUNIUM METAL IN THE RANGE 300–900°K. J. A. Lee, J. P. Evans, R. O. A. Hall, and E. King (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. and Chem. Solids 11, 278-83 (1959) Oct.

The electrical resistance of a sample of neptunium metal was measured between 300 and 900°K, and the resistivity of neptunium in its three allotropic modifications calculated. A measurement of the thermal e.m.f. of a neptunium/platinum thermocouple was made within the temperature-stable range of each allotrope, and the corresponding absolute thermoelectric powers calculated. The results are discussed briefly. (auth)

7801
MAGNETIC SUSCEPTIBILITY OF Ce–Th ALLOY. Tsuyoshi Murao (Tohoku Univ., Sendai). Progr. Theoret. Phys. (Kyoto) 22, 307-9(1959) Aug.

The susceptibility of Ce metal in which the α fraction of the 4f electrons is promoted into the conduction band was calculated. Comparisons of experimental and calculated susceptibility curves indicate the fraction of the promoted 4f electrons increases as the temperature is lowered. (C.J.G.)

7802
CERTAIN ANOMALIES IN THE PROPERTIES OF FERRO–ALUMINUM ALLOYS AND THEIR NATURE. P. P. Kuzmenko and P. V. Petrenko (Shevchenk Kiev State Univ.). Ukraïn. Fiz. Zhur. 4, 497-503(1959) July-Sept. (In Ukrainian)

Results are presented of an experimental investigation of the dependence of the lattice parameter on the concentration and temperature, and on the oxidability of ferro-aluminum alloys with 16, 20, 25, 30, 35, 40, and 50 at. % of Al at 1200°C in air. It is shown that the anomalous dependence of the lattice parameter on the concentration is preserved throughout the temperature range investigated (up to 1000°C). There is, however, a considerable deformation of the curve of dependence of the parameter on concentration with change of temperature. The alloys investigated may be divided into groups by concentration with respect to the tendency to oxidation at 1200°C. The first embraces the interval from 16 to 20% Al, and the second from 20 to 50% Al. The oxidability of the second group depends slightly on the concentration and has a value of the order of 2 g/mk · hour with a 30 to 40 hour exposure in air. On passing from 20% to 16% the oxidability increases by a factor of 200. It is also shown that with a deformation of alloys with 35, 40, 50% Al the alloys become ferromagnetic. Subsequent annealing at 700°C for two hours leads to the disappearance of ferromagnetism. An explanation of the nature of the anomalous properties of the alloys is given from the standpoint of superposing ionic coupling due to redistribution of valent electrons among the component atoms in the alloy. (auth)

7803
X-RAY INVESTIGATION OF SHORT RANGE ORDER IN Sn–Bi ALLOYS IN A LIQUID STATE. Ya. I. Dutchak

(Frank Kiev State Univ.). Ukraïn. Fiz. Zhur. 4, 504-7 (1959) July-Sept. (In Ukrainian)

Results are presented of an x-ray investigation of Sn–Bi alloys (10 and 20% Bi by weight) in a liquid state. As a result of an analysis of the radial distribution curves a conclusion is drawn about the statistical distribution of atoms in the alloys investigated. In the case of an alloy with 10% by weight of Bi the radius of the first coordination sphere equals 3.22 A, while the coordination number equals 9.9. On increasing the concentration of Bi in the alloy the radius of the coordination sphere and the coordination number increase, and in the case of an alloy with 20% by weight of Bi they equal r = 3.23 A; z' = 10.2. (auth)

7804

ELECTRON EMISSION PROPERTIES OF METAL-LIKE COMPOUNDS. G. V. Samsonov, V. S. Neshpor, and Yu. B. Paderno (Inst. of Metalloceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Ukraïn. Fiz. Zhur. 4, 508-18(1959) July-Sept. (In Ukrainian)

This paper offers an explanation of the electric properties and the work function of transition metals and their compounds with boron, carbon, silicon, and nitrogen. These properties are found to depend on the criterion $\xi = 1/z \cdot n$. Methods are described for obtaining hexaborides of rare-earth metals, their pseudobinary alloys and compact samples of these materials. (auth)

7805

DIFFUSION OF RADIOACTIVE RARE GASES IN URANIUM OXIDES AND URANIUM MONOCARBIDE. R. Lindner and Hj. Matzke (Technische Hochschule, Göteborg). Z. Naturforsch. 14a, 1074-7(1959) Dec. (In German)

The diffusion of Kr^{85} into UO_2 (various oxygen contents) and U_3O_8, of Rn^{222} into U_3O_8, and of Xe^{133} into UC was investigated. The results are graphed in the usual manner ($\log D = f(1/T)$). The proportionality found for Xe^{133} between the diffusion constant and the oxygen excess was found also for Kr^{85} in uranium dioxide. In U_3O_8 the diffusion of Kr^{85} and Xe^{133} is approximately the same, but the diffusion of Rn^{222} is about $1\frac{1}{2}$ to 2 powers of ten lower. The diffusion of Xe^{133} is higher than in UO_2. The results are briefly discussed. (J.S.R.)

7806

THE RELATIONSHIP OF THE MULTICRYSTAL ELASTICITY CURVE WITH THE SINGLE CRYSTAL ELASTICITY CURVE IN ALUMINUM. P. Derner and E. Kappler (Universität, Münster, Ger.). Z. Naturforsch. 14a, 1080-1 (1959) Dec. (In German)

Measurements of the elasticity curve for aluminum multicrystals were made on samples of 99.5% and 99.99% purity and with particle sizes from 0.05 to 5 mm. The curve obtained shows two distinct regions. In the first region the solidification curve is almost linear, and the expansion is greater at low temperatures than at high. Also it is greater for coarse particles than for fine particles. In the second region the rise of the solidification curve decreases with increasing deformation. It is strongly temperature dependent and independent of the particle size. The results suggest that it would not be possible to describe the total solidification mechanism by a single mathematical function. It is probable that the calculation of the multicrystal curve from the single crystal curve must be done by different methods for the two multicrystal regions. (J.S.R.)

7807

THE WORK-SOFTENING EFFECT IN ALUMINUM MULTICRYSTALS. P. Derner and E. Kappler (Universität, Münster, Ger.). Z. Naturforsch. 14a, 1082(1959) Dec. (In German)

In the transition from higher to lower temperatures (from 20° to –195°C) a reversible yield point increase occurs in aluminum multicrystals. In addition to this reversible change an irreversible change also occurs. The irreversible change is independent of the previous history of the material, but is dependent on the intermediate deformation before the lowest temperature. The results indicate that the yield point ratios must approach a saturation value with increasing preliminary deformation. (J.S.R.)

7808

X-RAY DIFFRACTION STUDIES OF IRRADIATED AND GROUND GRAPHITES. G. E. Bacon (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.475-80 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

X-ray-diffraction studies were performed on the degradation of graphite crystal structure by neutron bombardment and mechanical grinding. Attention is given the dependence of the degradation on the temperature of irradiation and any subsequent annealing. (C.J.G.)

7809

STUDIES OF CARBON POWDERS UNDER COMPRESSION [PART] I. S. Mrozowski (Univ. of Buffalo). p.495-508 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

Systematic studies of carbon powders under compression were carried out in an effort to clarify the mechanism of various effects observed and to provide a practical method for determination of some physical properties of the material. The electrical resistivity ρ of screened carbon powders diminishes with increase of pressure $P(\rho \cong P^{-0.5})$ and with increase of the particle size $r(\rho \cong r^{-1/4})$. Packing increases with the pressure at a slow rate $(\cong P^{0.1} - P^{0.2})$; elastic expansion at release of pressure varies about in proportion to $P^{1/3}$ and to $r^{-1/4}$. Results on creep, hysteresis effects, and crushing are reported. The pressure dependence of resistivity is explained in terms of Holm's theory of electrical contacts. It is shown that the variation in the size of contact areas gives the main contribution, the density of packing providing a minor correction factor. On basis of formulas developed the upper limit of the micro-hardness, H (mechanical yield limit) is estimated for soft and hard carbons. For soft carbons a logarithmic creep is observed when they are in calcined state, but none when they are graphitized. A very strong maximum of elasticity was found for heat treatment to about 2400°C. Prolonged grinding to a very fine size creates an oxide surface film, the presence of which is evidenced by an increase in resistivity and also by a change in its pressure dependence. Such films are removed by heat treatment to 1000°C and the normal behavior restored. By comparing properties of calcined carbon powders ground before further heat treatment with those of powders ground after heat treatment it is shown that the graphitization process is greatly modified by the early comminution of the material. (auth)

7810

THERMAL PROPERTIES OF GRAPHITE. J. E. Hove (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). p.515-27 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

The thermal expansion and thermal conductivity of

graphite are discussed from the viewpoint of the basic mechanisms involved. A general review of the theory of these properties for more general classes of materials is given. Since the thermal expansion of a graphite single crystal is negative in the a-direction, the various mechanisms which have been proposed to explain negative thermal expansion are briefly reviewed. The phenomenological theory of thermal conductivity of insulating solids is discussed and applied to artificial graphites. A general discussion is then made of defect scattering and the difficulties involved in the theory of this and of the mechanisms involved at high temperatures are brought out. A discussion is also presented of the electronic effects in the thermal conduction of non-insulators. (auth)

7811

HEAT-FLUX-RUPTURE LIMITS WITH INTERNAL HEAT GENERATION OF SEVERAL GRAPHITES UP TO 5000° FAHRENHEIT. W. B. Powell and P. E. Massier (California Inst. of Tech., Pasadena). p.543-57 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

An apparatus was devised in which graphite specimens could be subjected to thermal stress so that the limiting values of internal heat generation rate could be determined. Graphite specimens 0.125 in. thick, 0.75 in. wide, and 7 in. long were mounted in a passage having blackened water-cooled mild-steel walls. The specimen was heated with an electric current. Pure nitrogen was used as a coolant and in the passage. Specimens were cut with differing grain orientations from three different grades of graphite. Thermal stress fractures were induced at surface temperatures between 3200 and 5100°F. The maximum heat-generation rate achieved was approximately 200 MW/ft^3, corresponding to a surface heat flux of 5.75 $Btu/in.^2$ sec. (auth)

7812

MAGNETIC SUSCEPTIBILITIES AND THERMAL EXPANSION OF ARTIFICIAL GRAPHITES. P. Cornuault, A. Herpin, H. Hering, and M. Seguin (Commissariat a l'Energie Atomique, Paris). p.627-31 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

From measurements of the magnetic susceptibility made in the two principal directions of a graphite bar, the distribution function of the normals to the carbon planes in the crystallites was evaluated. The effect of different variation in the manufacturing process on this crystalline anisotropy was studied. From this crystalline anisotropy the thermal expansion coefficient possessed by a compact mass of crystallites having exactly the same orientational anisotropy as the porous body under consideration was calculated. The difference between this and the observed expansion coefficient leads to the determination of the expansion of the non-graphitic part of the mass which resulted in a negative value and is also anisotropic. (auth)

7813

EFFECT OF IMPREGNATION AND SUBSEQUENT BURN-OFF ON PHYSICAL PROPERTIES OF GRAPHITIZED CARBON RODS. P. L. Walker, Jr. and F. Rusinko, Jr. (Pennsylvania State Univ., University Park). p.633-42 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

Graphitized carbon rods were impregnated three, seven, and twelve times with a low melting point pitch and the samples then baked at 790°C. The original rods are shown to have a significant closed pore volume, which is appreciably opened up upon burn-off. Impregnation was found to progressively lower the specific surface area and macroporosity (porosity primarily between particles) in the rods. Subsequent gasification of the rods to "constant" burn-off at different temperatures was seen to change the surface areas, helium densities, apparent densities, and porosities of the rods in ways which are qualitatively explainable. The impregnated rods were found to have higher gasification rates than the original rods with carbon dioxide at 1000 and 1100°C, which is a result of the high reactivity of the impregnant. At 900°C, the higher surface area of the unimpregnated rods counterbalances the higher reactivity of the impregnant and results in essentially a constant rate for all rods. Changes in electrical resistivity of the rods, as a function of impregnation and subsequent burn-off, are presented. The diffusion rate of gas through the rods was seen to be markedly decreased by impregnation. (auth)

7814

EFFECT OF DIFFERENT COKES ON PHYSICAL PROPERTIES OF GRAPHITIZED CARBON PLATES. P. L. Walker, Jr., F. Rusinko, Jr., and J. F. Rakszawski (Pennsylvania State Univ., University Park) and L. M. Liggett (Speer Carbon Co., St. Marys, Penna.). p.643-58 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

The impregnation effects of twelve different calcined cokes (the coal tar pitch binder being kept the same) on the physical properties of graphitized carbon, molded plates was investigated. Changes in the bulk density, weight, and volume of the carbon plates as they proceed from the green through the baked to the graphitized state are presented. True, helium, and apparent density data are presented for the calcined cokes and their graphitized plate counterparts. The gas reactivity, coefficient of thermal expansion, electrical resistivity, and tensile breaking strength of the graphitized carbon plates are related to the specific surface area, total pore volume, total open-pore volume, total closed-pore volume, open macropore volume, and intensity of the (002) x-ray diffraction peak for both the calcined cokes and graphitized plate material. Explanations for the variations in these four important properties of the graphitized carbon plates are presented. (auth)

7815

THERMAL EXPANSION OF POLYCRYSTALLINE CARBONS AND GRAPHITES. [PART] II. F. M. Collins (Univ. of Buffalo). p.659-74 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

Studies of changes in the thermal expansion of polycrystalline carbons and graphites by variations in the processing conditions were performed. The measurements were made with a quartz dilatometer in the range from room temperature to 800°C. The average thermal expansion of individual $\frac{1}{8}$ in. pieces of Kendall coke was found to be (1) much greater than that of the original 2 in. uncut piece of coke, (2) larger after pitch impregnation and baking, and (3) smaller when the pieces were cut from the 2 in. piece before calcination. The thermal expansion of (non-impregnated) pitch-bonded carbons was found to decrease with increase of binder coke density $(d-d_0)$, increase with increase in filler packing density d_0, and inversely with the coke particle size. Results are reported relating to the variation of thermal expansion with (1) the temperature of calcination of the coke, (2) the ambient temperature of measurement, (3) the temperature of heat treatment, and (4) the introduction and removal of interstitial bisul-

fate ions. Data as to the correlation between the anisotropies of the thermal expansion and of the magnetic susceptibility are presented. The nature of some of the effects observed is discussed and tentative explanations are proposed. (auth)

7816

ELECTRICAL RESISTIVITIES AND CRUSHING STRENGTHS OF BAKED CARBONS. E. J. Seldin (Univ. of Buffalo). p.675-86 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

Measurements were made of the electrical resistivities of baked carbons made with a definite particle size and different binder contents and having the same filler density, the carbons being impregnated with coke and rebaked several times. The values of $1/\rho^2$ increase linearly with $d-d_0$ for each sample up to one or two impregnations. The slopes of these lines increase with increasing binder content until an optimum binder content is reached, above which they start to decrease. However, for very low and very high binder contents the initial sections of the curves are not linear. With further impregnation, the slopes of the different curves all increase and all the curves join together, forming a single curve. The initial linear sections of the curves are of the type required by the formula of Mrozowski. The crushing strengths of baked carbons increase with an increase of both the apparent density and the binder content. The crushing strengths of impregnated baked carbons made with a wide range of binder contents increase linearly with $d-d_0$ up to several impregnations, as expected according to the formula of Mrozowski. For impregnated baked carbons made with very low binder content, the curves of strength vs. d are similar to the curves $1/\rho^2$ vs. d. The strengths of baked carbons decrease if the samples are molded under excessively high pressures. The resistivities of baked carbons made with single size particles and a given binder content are found to be roughly independent of the size of the particles for all but the smallest particle sizes. The resistivities of baked carbons made with mixtures of two particle sizes and a given binder content are independent of the relative proportions of the two particle sizes and are equal, within the limits of experimental error, to the values of the resistivities of baked carbons made with single size particles and the same binder content and having the same apparent and filler densities. (auth)

7817

PERMEABILITIES OF BAKED CARBONS AND BEDS OF CARBON POWDERS TO THE FLOW OF A GAS. E. J. Seldin and S. Mrozowski (Univ. of Buffalo). p.687-703 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

Baked carbons were prepared by molding mixtures of calcined Texas-Lockport petroleum coke particles and coal tar pitch binder and baking to temperatures of approximately 1000°C. The coke particle sizes, binder contents, and molding pressures were varied in the preparation of samples. The permeabilities of the baked carbons and beds of packed carbon particles to the flow of nitrogen were determined. For the flow velocities used, the flow followed Darcy's law. For baked carbons made with a given binder content and having the same apparent and filler densities, the permeability was found to be proportional to the 4/3 power of the weighted average particle size. For baked carbons made with one-sized coke particles and having the same apparent density d and different filler densities d_0, the permeability was found to be lower as the filler density d_0 was higher. A model of constriction resistances is used to explain the variation of the permeability with the particle size and with the filler and apparent densities. (auth)

7818

COLLOQUE SUR LA DIFFUSION A L'ÉTAT SOLIDE. ORGANISÉ A SACLAY LES 3, 4 ET 5 JUILLET, 1958. (Symposium on Solid State Diffusion. Organized at Saclay 3, 4, and 5 July, 1958). Saclay, France, Centre d'Études Nucléaires, 1959. 178p.

Twenty-one papers are included; separate abstracts have been prepared for ten. (D.E.B.)

7819

AUTORADIOGRAPHIC INVESTIGATION OF THE DIFFUSION OF CHROMIUM IN TITANIUM. A. J. Mortlock (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.13-16 of "Colloque sur la Diffusion a l'État Solide. Organisé à Saclay les 3, 4, et 5 Juillet, 1958." Saclay, France, Centre d'Études Nucléaires, 1959. 178p. (In English)

Autoradiographic measurements of the self-diffusion of Cr in body centered cubic Ti-Cr alloys are described, and the advantages of the technique are emphasized. Comparison experiments aimed at establishing the validity and interpretation of the results are also detailed. The activation energies observed range from 37.7 kcal/mol for pure Ti to 44.5 kcal/mol for Ti + 18% Cr alloy. These figures are low in comparison with the figure which might be expected from the relatively high melting point of the alloys. It is suggested that this discrepancy may be due to the operation of a diffusion process analogous to Johnson diffusion in face centered cubic metals. (auth)

7820

THE DIFFUSION AND PRECIPITATION OF HELIUM INJECTED INTO METALS. R. S. Barnes (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.58-64 of "Colloque sur la Diffusion a l'État Solide. Organisé à Saclay les 3, 4 et 5 Juillet, 1958." Saclay, France, Centre d'Études Nucléaires, 1959. 178p.

A high concentration of helium atoms can be produced locally within a metal by bombarding its surface with alpha-particles. The behavior on heating the metals beryllium, copper, and aluminum containing such a concentration of helium has been studied. It is concluded that the helium atoms are initially in solution and only precipitate as a very fine dispersion of gas bubbles when vacancies become available to them. Re-solution occurs permitting a redistribution of the helium which is most rapid at the grain boundaries. (auth)

7821

ENERGY OF SOLUTION OF RARE GASES IN METALS. J. Blin (Centre d'Études Nucléaires, Saclay, France). p.65-72 of "Colloque sur la Diffusion a l'État Solide. Organisé à Saclay les 3, 4 et 5 Juillet, 1958." Saclay, France, Centre d'Études Nucléaires, 1959. 178p.

The energies of solution of the rare gases Ar, Kr, and Xe in Cu, Ag, and U were calculated. The results of Jensen's study of compressibility of rare gases were used in the calculations. (C.J.G.)

7822

APPARATUS FOR STUDYING THE DIFFUSION OF RARE GASES IN STAINLESS STEEL. J. A. Stohr and L. Alfille (Centre d'Études Nucléaires, Saclay, France). p.73-8 of "Colloque sur la Diffusion a l'État Solide. Organisé à Saclay les 3, 4 et 5 Juillet, 1958." Saclay, France, Centre d'Études Nucléaires, 1959. 178p.

An apparatus for measuring the diffusion of gaseous fission products and other gases across thin metallic walls at high temperatures is described. (C.J.G.)

7823

THREE DIMENSIONAL DIFFUSION AND INTERGRANULAR DIFFUSION OF OXYGEN IN ZIRCONIUM. G. Sainfort, R. Jacquesson, and P. Laurent (Université de Poitiers, France). p.79-84 of "Colloque sur la Diffusion a l'État Solide. Organisé à Saclay les 3, 4 et 5 Juillet, 1958." Saclay, France, Centre d'Études Nucléaires, 1959. 178p.

The value of the senary axis c (six fold axis of symmetry) in the hexagonal zirconium matrix is particularly influenced by the presence of oxygen in the metallic structure. Using a high sensivity diffractometer, value of c and its variation with depth for zirconium oxidized at different temperatures was measured. According to the results obtained, diffusion takes place along the grain boundaries at temperatures in the neighborhood of 770°C whereas the diffusion takes place three dimensionally throughout the metal itself at temperatures around 980°C. (auth)

7824

BRITTLENESS IN THE ZONE OF DIFFUSION OF URANIUM AND ZIRCONIUM. A. Winogradzki and N. Azam (Centre d'Études Nucléaires, Saclay, France). p.85-94 of "Colloque sur la Diffusion a l'État Solide. Organisé à Saclay les 3, 4 et 5 Juillet, 1958." Saclay, France, Centre d'Études Nucléaires, 1959. 178p.

An investigation to find the thermal treatment giving the maximum adherence between uranium-zirconium fuel bars (containing 2% zirconium) and their zirconium canisters (elements formed by co-extrusion) is described. In the raw extruded bars the adherence is due to a thin film ($e \cong 1\ \mu$) formed by diffusion, composed of the phase δ (ϵ) of the system uranium-zirconium. Annealing at approximately 600°C modifies the structure of the diffusion layer and the attachment of the bar to the can becomes very brittle. This brittleness did not occur in elements annealed at higher temperatures but if the annealing lasts too long, diffusion is accompanied by pore formation and a consequent reduction in mechanical strength. It is therefore concluded that the best treatment is to anneal the elements for a short time at temperatures above 720°C. (auth)

7825

STUDY OF URANIUM–TITANIUM DIFFUSION. Y. Adda and J. Philibert (Centre d'Études Nucléaires, Saclay, France). p.103-9 of "Colloque sur la Diffusion a l'État Solide. Organisé à Saclay les 3, 4 et 5 Juillet, 1958." Saclay, France, Centre d'Études Nucléaires, 1959. 178p.

An investigation of uranium-titanium diffusion showed that intergranular diffusion occurred at temperatures below 650°C. At higher temperatures, the diffusion occurred uniquely throughout the volume of the metal, and the diffusion zone appeared as a succession of micrographically distinguishable bands. A study of the rate of increase of these bands made possible the measurement of the corresponding "penetration coefficients." Variations in microhardness within the diffusion zone were observed and attempts to relate these variations to the variation of concentration were made. The concentration-penetration curves for temperatures between 950 and 1075°C were established. From these curves, the diffusion coefficient D was calculated as a function of the concentration using Matano's method. At all temperatures, D (c) curve has a U form as for the U-Zr system. The activation energy has a maximum value of 42 kcal/g atom at an atomic concentration of 0.5. A Kirkendall effect was observed in the diffusion zone by studying the displacements x_i of the interface using tungsten wires as markers. Using Darken's equations, the intrinsic diffusion coefficients D_U and D_{Ti} were calculated as well as the corresponding activation energies. These energies are similar ($Q_U = 38.5$ and $Q_{Ti} = 40$ kcal/at g) and also almost the same as those found for the U-Zr system. (auth)

7826

DIFFUSION OF ALUMINUM DURING THE TRANSFORMATION UAl_3–UAl_4 IN THE SOLID STATE. R. Boucher (Centre d'Études Nucléaires, Saclay, France). p.111-17 of "Colloque sur la Diffusion a l'État Solide. Organisé à Saclay les 3, 4 et 5 Juillet, 1958." Saclay, France, Centre d'Études Nucléaires, 1959. 178p.

The evolution of the transformation $UAl_3 \rightarrow UAl_4$ was followed micrographically to observe the diffusion of aluminum. The kinetics of the transformation were strongly influenced by the presence of elements such as silicon in relatively small quantities. In the absence of silicon, UAl_3 crystals were transformed to UAl_4 in approximately one hour. For low silicon contents (0.1% by weight) the transformation took ten times longer. Silicon concentrations of 0.6% practically stop the transformation. After a hundred hours a slight transformation is observed, but this transformation is no further advanced after 1,000 hours. (auth)

7827

PROTECTION OF URANIUM BY ELECTRODEPOSITION OF NICKEL AND DIFFUSION. G. Chauvin, H. Coriou, and J. Hure (Centre d'Études Nucléaires, Saclay, France). p.119-31 of "Colloque sur la Diffusion a l'État Solide. Organisé à Saclay les 3, 4 et 5 Juillet, 1958." Saclay, France, Centre d'Études Nucléaires, 1959. 178p.

It is demonstrated that after having treated a uranium surface it is possible to electroplate nickel on it in such a way that after annealing without the application of any pressure these deposits give a very good intermetallic U-Ni diffusion. When no other factor varies, experiments show that the quality of the diffusion zones obtained depends on the nature of the electrolytic nickel bath. The classical nickel baths used for this type of work contained 20 to 40 g/l of boric acid acting as an electrolytic buffer. As a result, the deposits were highly contaminated by boron (400 to 500 PPM of boron). It is shown that with a bath which does not contain nuclear poisons, a very clean U-Ni diffusion zone can be obtained. After annealing for 100 hours at 700°C, microscopic examination of the diffusion front revealed the existence of five layers under bright field illumination and six layers in polarized light, at least four of these layers were well crystallized. Important irregularities in the interface between uranium and the first intermetallic compound U_6Ni seem to be the result of barriers to the diffusion caused by certain impurities in the uranium. Of the seven definite compounds which can be formed during the diffusion, that which is richest in nickel UNi_5 is the hardest and most brittle. This brittleness results in the systematic appearance of fractures at the Ni-UNi_5 interface where all the diffusion layers remain fixed to the uranium. (auth)

7828

CONTRIBUTION TO THE STUDY OF DIFFUSION IN A POLYPHASE SYSTEM. J. Philibert and Y. Adda (Centre d'Études Nucléaires, Saclay, France). p.163-70 of "Colloque sur la Diffusion a l'État Solide. Organisé à Saclay les 3, 4 et 5 Juillet, 1958." Saclay, France, Centre d'Études Nucléaires, 1959. 178p.

Kinetic studies of polyphase diffusion in the systems U-Zr and U-Mo were studied. Various methods based on

purely micrographical studies (measurement of the thickness of intermediate phases) were proposed for evaluating the coefficient of diffusion. Experimental results show that the hypotheses on which these methods are based are rarely valid. Concentration-penetration curves were established for the systems U-Zr (between 590 and 950°C) and U-Mo (between 800 and 1050°C). These curves often exhibit a very accentuated curvature, thus indicating variations in the diffusion coefficient, which cannot be expressed by simple relationships. Certain anomalies were observed in the neighborhood of the interfaces between adjacent phases. The Kirkendall effect in a polyphase system was studied by marking the plane of welding with tungsten wires, and compared these results to those from a previous study in the homogeneous phase. It was found that the presence of phase boundaries accentuates this effect. The interpretation of this latter result and of the anomalies in the coefficient of diffusion should probably take into account the accumulation of reticular defects which would appear after displacement of the phase boundaries. (auth)

7829

URANIUM BISMUTHIDE DISPERSION IN MOLTEN METAL. R. J. Teitel (to U. S. Atomic Energy Commission). U. S. Patent 2,910,417. Oct. 27, 1959.

The formation of intermetallic bismuth compounds of thorium or uranium dispersed in a liquid media containing bismuth and lead is described. A bismuthide of uranium dispersed in a liquid metal medium is formed by dissolving uranium in composition of lead and bismuth containing less than 80% lead and lowering the temperature of the composition to a temperature below the point at which the solubility of uranium is exceeded and above the melting point of the composition.

7830

HEAT TREATED U–Nb ALLOYS. R. K. McGeary and W. M. Justusson (to U. S. Atomic Energy Commission). U. S. Patent 2,914,433. Nov. 24, 1959.

A fuel element for a nuclear reactor is described comprising an alloy containing uranium and from 7 to 20 wt. % niobium, the alloy being substantially in the gamma phase and having been produced by working an ingot of the alloy into the desired shape, homogenizing it by annealing it at a temperature in the gamma phase field, and quenching it to retain the gamma phase structure of the alloy.

7831

FORMATION OF INTERMETALLIC COMPOUND DISPERSIONS. J. S. Bryner (to U. S. Atomic Energy Commission). U. S. Patent 2,915,445. Dec. 1, 1959.

A method is presented for preparing dispersions containing thorium bismuthide in equiaxed form and having an average particle size of about 30 microns. Thorium particles having one dimension not greater than 0.015 in. are immersed in liquid bismuth at a temperature between 500 and 600°C, the quantity of thorium being in excess of its solubility in the bismuth.

7832

TUNGSTEN BASE ALLOYS. D. H. Schell and H. Sheinberg (to U. S. Atomic Energy Commission). U. S. Patent 2,916,809. Dec. 15, 1959.

A high-density quaternary tungsten-base alloy having high mechanical strength and good machinability composed of about 2 wt.% Ni, 3 wt.% Cu, 5 wt.% Pb, and 90 wt.% W is described. This alloy can be formed by the powder metallurgy technique of hot pressing in a graphite die without causing a reaction between charge and the die and without formation of a carbide case on the final compact, thereby enabling re-use of the graphite die. The alloy is formable at hot-pressing temperatures of from about 1200 to about 1350°C. In addition, there is little component shrinkage, thereby eliminating the necessity of subsequent extensive surface machining.

7833

URANIUM ALLOYS. E. W. Colbeck (to U. S. Atomic Energy Commission). U. S. Patent 2,919,186. Dec. 29, 1959.

A uranium alloy is reported containing from 0.1 to 5 per cent by weight of molybdenum and from 0.1 to 5 per cent by weight of silicon, the balance being uranium.

Radiation Effects

7834 AD-214727

American Can Co., Barrington, Ill.

RESEARCH STUDY ON CAN ENAMELS AS PART OF THE RADIATION PRESERVATION OF FOODS PROGRAM. Report No. 5 (Progress) [for] July 29, 1958–September 28, 1958. G. B. Pratt and A. C. Wilbur. 15p. Project No. 7-84-01-002. Contract DA-19-129-QM-968.

For cans of irradiated chili, cherries, and beef, some enamels did not appear adversely affected after several months' storage. Cans of codfish were irradiated, and some enamels did not appear adversely affected before storage. (auth)

7835 AD-215601

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

ANNEALING OF RADIATION DAMAGE IN SEMICONDUCTING DEVICES (thesis). Vern Elrick Bryson. Mar. 1959. 41p.

The results and discussion of experiments to determine the effects of radiation upon silicon carbide diodes are presented. An electrical field sweeping effect was discovered. This effect occurred when a voltage was applied to the diode in either forward or back direction. This applied voltage appears to remove all accumulation of radiation effects of a permanent nature to the extent that a constant back current characteristic could be maintained during irradiation from 0 to 1.18×10^{16} nvt. After an 1.18×10^{16} nvt integrated dose, the diodes tested had a forward to back current ratio of approximately 7400, indicating these devices to be as good as they were at the beginning of the experiment. (auth)

7836 AD-218500

Purdue Univ., Lafayette, Ind.

ALPHA-PARTICLE IRRADIATION OF GERMANIUM AT 4.2°K. Supplement to Quarterly Report No. 7. Garth William Gobeli. Jan. 1958. 78p.

Employing a sealed Po^{210} alpha-particle source having an effective energy of 3.73 Mev, degenerate n-type and p-type Ge samples were irradiated at 4.2°K. In samples held for 20 hours at 4.2°K following irradiations no changes in the electrical properties were observed. Thermal annealing in degenerate n-type and p-type Ge samples after irradiation at 4.2°K was studied up to 78°K. (W.D.M.)

7837 AD-218752

Crown Zellerbach Corp. Western-Waxide Div., San Leandro, Calif.

INVESTIGATION OF THE EFFECTS OF RADIATION ON WAXES AND WAX COATED PAPER PRODUCTS. Report No. 2 (Progress) [for] May 1, 1958 through July 31, 1958. J. E. Smith. 18p. Project No. 7-84-01-002. Contract QMR&E (Natick) No. 92 (Agreement).

After three months' storage at 72°F and 50% R.H. irradiated samples of waxes, wax blends, and waxed papers generally showed no increasing effects from earlier ir-

radiation. An exception to this was the continued increase in viscosity of a wax blend which contained butyl rubber; this is attributable to continuing rubber cross linkage. Other changes in waxes and wax blends were negligible. Decreases in waxed paper strength properties observed in initial tests were also found after the three month storage period; these included tear strength, bursting strength, and folding endurance. (auth)

7838 AD-220199

Chatham Electronics. Div. of Tung-Sol Electric Co., Livingston, N. J.

DEVELOPMENT AND EVALUATION OF ELECTRON TUBE GLASSES RESISTANT TO RADIATION DAMAGE. Final Report [for] Period May 1, 1958 to April 30, 1959. G. R. Weinberg. 27p. DA Project No. 3-99-00-100. Contract DA-36-039-SC-75065.

Enclosures made of Corning 0080, 0120, 7720, 7520, 1720, and Owens-Illinois 51-26 glass without leads and with matching leads sealed-in were exposed to an integrated thermal neutron flux of 10^{16} nvt. Except for glass type 7052, no damage besides discoloration could be noticed. The 7052 glass with sealed-in molybdenum leads cracked when exposed to an integrated thermal neutron flux of 10^{16} nvt. Type 7720 glass with sealed-in tungsten leads cracked when exposed to an integrated thermal flux of 10^{17} nvt. (auth)

7839 AD-220268

Sutherland Paper Co. Research Labs., Kalamazoo, Mich.

PAPERBOARD CONTAINERS FOR IRRADIATED FOODS. Report No. 1 (Progress) for September 10, 1958–January 31, 1959. G. F. Rumberger. 14p. Project No. 7-84-01-002. Contract QMR&E (Natick) No. 109.

A typical packaging grade fiberboard has been exposed to gamma and beta radiation at both pasteurization and sterilization doses. Change of color, lowering of strength, and lowering of tear resistance are noted at sterilization doses. At pasteurization doses, there is little or no effect. Commercial grade inks are resistant to color change even at sterilization dosages. (auth)

7840 AD-220484

DeBell and Richardson, Inc., Hazardville, Conn.

TO INVESTIGATE MATERIALS FOR CONTAINERS FOR PACKAGING FOODS. Report No. 12 (Progress) [for] September 28, 1958–November 28, 1958. Wesley S. Larson. Dec. 28, 1958. 29p. Project No. 7-84-01-002. Contract DA-19-129-QM-764.

Results are reported from oxygen permeability tests on films, foils, and combinations thereof of interest as containers for foods undergoing irradiation. Irradiation tests were run on plastic bags filled with various acids and oils and on cements and coatings for use on standard tin plate cans. Data are tabulated. (C.H.)

7841 AECU-4637

Brown Univ., Providence. Metals Research Lab.

ANNUAL REPORT OF RESEARCH PROGRESS. Rohn Truell. Dec. 31, 1959. 9p. Contract AT(30-1)-1772. OTS.

Studies of the effect of reactor irradiation on germanium single crystals by means of measurement of the temperature dependence of ultrasonic velocity in a [1 0 0] direction before and after irradiation are presented. In-reactor measurements were made on Al single crystals and on quartz. (W.L.H.)

7842 BMI-1401

Battelle Memorial Inst., Columbus, Ohio.

HIGH-TEMPERATURE IRRADIATION ON A ZIRCONIUM HYDRIDE–2 w/o URANIUM ALLOY. Gerald E. Lamale, Alan W. Hare, Horatio H. Krause, Alan K. Hopkins, John H. Stang, Eugene M. Simons, and Ronald F. Dickerson. Dec. 10, 1959. 39p. Contract W-7405-eng-92. OTS.

Enriched $ZrH_{1.65}$–2 wt.% uranium specimens were irradiated under 1 atm. of hydrogen at center-line temperatures between 900 to 1400°F to uranium burnups of between 13 and 25 at.%. Specially designed irradiation capsules were used to provide the conditions of temperature and hydrogen atmosphere which were required. Each capsule was instrumented with five thermocouples so that ample temperature data could be obtained during the irradiation. Almost negligible density changes were produced in the material by the irradiation. Changes in length and diameter were of a degree which could fall within experimental error in measurement. Metallographic examination showed no change in microstructure which could be attributed to the effect of irradiation. (auth)

7843 BMI-1408

Battelle Memorial Inst., Columbus, Ohio.

A METHOD OF CORRELATING IRRADIATION EFFECTS IN DISPERSION FUELS. Donald L. Keller, Lewis E. Hulbert, and Bruce W. Dunnington. Jan. 20, 1960. 17p. Contract W-7405-eng-92. OTS.

A method of correlating irradiation effects in dispersion fuels was proposed in which the effects of irradiation conditions are considered independently of material variables. Two simple failure models were devised (failure by creep and by short-term stress yield). Criteria which permit estimates of the relative severity of tests made under different test conditions but on identical specimens were developed. Numerical application of the procedures for 18-8 stainless steel with 25 and 30 wt.% UO_2 specimens was attempted. No positive verification of the short-term stress model was obtained, but the creep model yielded the approximate failure limits for both specimen compositions. (auth)

7844 NP-8261

Nuclear Engineering Ltd., London.

THE EFFECT OF HIGH ENERGY RADIATION ON NATURAL AND SOME SYNTHETIC RUBBERS. Preliminary Report. [1955]. 51p.

The effects of radiation on the properties of natural rubber, butadiene-styrene rubber, Neoprene, butadiene-acrylonitrile rubber, silicone rubber, and butyl rubber were investigated. The use of high-energy radiation to cross-link rubber is discussed. The production of styrene-butadiene copolymers in the approximate ratio of 1:3 by radiation is reviewed. The mechanism of radiation cross-linking of polyethylene was studied. Specifications are given for a Co^{60} irradiation unit. (W.L.H.)

7845 WADC-TR-58-499

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

THE EFFECTS OF NUCLEAR RADIATION ON SOLID FILM LUBRICANTS. Period covered: October 1955 to August 1958. William L. R. Rice and William L. Cox. Sept. 9, 1958. 37p. Project title: AVIATION LUBRICANTS. Task title: LUBRICANT MECHANICAL EVALUATION. (AD-207795). OTS.

The effects of nuclear radiation on twelve commercial solid film lubricants were determined. The lubricants were typically phenolic or epoxy resin bonded, incorporating graphite or molybdenum disulfide. Gamma exposures covered the range 8.71×10^9 through 2.61×10^{11} ergs per gram carbon. Neutron exposures were over the range 1×10^{15} to 3×10^{16} nvt fast. Data were obtained on the wear

life, corrosion resistance, fluid resistance, and thermal stability. It was observed that radiation, in certain instances, improved wear life rather than decreasing it. Also those solid films that possessed good corrosion and fluid resistance and good thermal stability prior to irradiation generally were not seriously changed in these properties. Films of poor initial properties were greatly degraded by the radiation. It was concluded that certain of the films should be useable up to the maximum dosages used, but that careful selection would be necessary. (auth)

7846

MONOENERGETIC NEUTRON IRRADIATION OF GERMANIUM. O. L. Curtis, Jr. and J. W. Cleland (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 31, 423-7(1960) Feb.

A study was made on 14-Mev neutron-irradiated germanium, using lifetime, Hall, and resistivity measurements to determine the nature of the radiation-induced defects and to compare the damage with that produced by neutrons from a fission spectrum. The electron removal rate in high-resistivity, n-type material is $\sim 8/cm^{-3}$ per incident neutron/cm^2, measured at 77°K. Lifetime measurements were made on n- and p-type material. On the basis of simple recombination theory, assuming no variation of capture probabilities with temperature, the results for n-type material indicate that a recombination level is located 0.32 ev above the valence band near the center of the energy gap. Assuming an introduction rate of recombination centers equal to one-half the electron removal rate in n-type material, the following values of recombination capture cross sections are obtained: $\sigma_n = 2.2 \times 10^{-17}$ cm^2; $\sigma_p = 6 \times 10^{-15}$ cm^2, the latter value being correct only within about a factor of two. The ratio of the cross sections, σ_p/σ_n, which is independent of the method of determining the number of recombination centers, is ~ 300, indicating that the recombination centers are negatively charged. The lifetime measurements for p-type germanium are not so readily analyzed. Possible explanations for observed behavior are discussed. (auth)

7847

MICROWAVE DETERMINATION OF PLASMA DENSITY PROFILES. Charles B. Wharton and Donald M. Slager (Univ. of California, Livermore). J. Appl. Phys. 31, 428-30(1960) Feb.

A method for the rapid determination of the average electron density and of the spatial electron density distribution in plasmas is presented. The technique employed permits time-resolved measurements over a wide range of electron densities, introducing little or no perturbation into the gaseous discharge. The quantities measured by the described techniques were correlated previously with other plasma measurements and show reasonably good agreement. (auth)

7848

ANNEALING OF γ-RAY DAMAGE IN GERMANIUM. Tsunesaburo Asada, Haruo Saito, Kazumi Omura, and Taiji Oku (Osaka Univ.) and Masahiro Oka (Shimane Univ., Japan). J. Phys. Soc. Japan 15, 93-4(1960) Jan.

Isothermal annealing of germanium single crystals irradiated by γ rays from Co^{60} was studied. The variation of conductance with time was measured. The conductance curves are composed of three stages. To explain this fact, the model proposed by Fletcher and Brown may be employed with a certain modification. From the analysis of these curves, the activation energy of the direct recombination of vacancy interstitial pairs, that for the diffusion of interstitial atoms and that for the diffusion of vacancies were determined to be 0.765, 0.741, and 1.250 ev., respectively. (auth)

7849

RADIATION-RESISTANT FLUIDS AND LUBRICANTS. William L. R. Rice and David A. Kirk (Wright Air Development Center, Wright-Patterson, AFB, Ohio) and William B. Cheney, Jr. (Air Force Inst. of Tech., Wright-Patterson, AFB, Ohio). Nucleonics 18, No. 2, 67-71(1960) Feb.

Tests were performed using solid-film lubricants, greases, and fluids to investigate their stability at high temperatures and their resistance to radiation. The solid-film lubricants generally consisted of a finely divided solid, such as graphite or molybdenum disulfide, affixed to the bearing surface by a resin bonding agent. The primary drawback in the development of high-temperature radiation-resistant greases was the inadequacy of the base fluid. The terephthalamate-thickened alkyl diphenyl ethers show much promise as greases and are usable from −30 to 350°F at radiation dosages exceeding 7×10^{10} ergs/g °C. The polyphenyl ethers are of particular interest as base fluids and are operative in the 800 to 900°F region at dosages of 10^{11} ergs/g °C. (B.O.G.)

7850

DETECTION OF IRRADIATION EFFECTS BY DIFFERENTIAL THERMAL ANALYSIS. C. B. Murphy and J. A. Hill (General Electric Co., Schenectady, N. Y.). Nucleonics 18, No. 2, 78; 80(1960) Feb.

Differential thermal analysis, in which endothermic and exothermic peaks are recorded during slow heating of a material, was found useful for indicating radiation damage in organic material and may be useful as a dosimetry technique. The thermoelectric output of a differential thermocouple circuit, which differentiates between the temperatures of an irradiated and an unirradiated sample, is plotted versus time (or temperature in programmed heating systems). The application of the DTA technique to the detection of changes induced by radiation in biphenyl, polyvinyl chloride, Teflon, and Versalube F-50 is reported. (B.O.G.)

7851

RADIATION EFFECTS IN SILICA AT LOW TEMPERATURES. George W. Arnold and W. Dale Compton (U. S. Naval Research Lab., Washington, D. C.). Phys. Rev. 116, 802-11(1959) Nov. 15.

Optical absorption bands induced in fused silica and crystalline α quartz of low impurity content at 77°K by fast electrons or x rays bleach slowly at room temperature. The presence of OH^- ions in fused silica inhibits the formation of such radiation-induced absorption. Comparison of the number of centers produced at 215 mμ (C band) in Corning 7943 fused silica (OH^- free) for equal absorbed dose when irradiated with electrons and x rays indicates that displacements are not involved in the initial formation of the color centers. A defect model requiring simple ionization seems adequate to explain most of the observed phenomena in this pure fused silica. No simple model can be proposed which adequately describes the data in the case of the Corning 7940 fused silica (OH^- bearing). (auth)

7852

OPTICAL DETECTION OF VACANCIES CREATED BY HIGH-ENERGY RADIATION IN SODIUM CHLORIDE. H. W. Etzel and J. G. Allard (U. S. Naval Research Lab., Washington, D. C.). Phys. Rev. 116, 885-7(1959) Nov. 15.

The presence of vacancies created by high-energy radiation in sodium chloride single crystals was detected by comparing the F-center coloration produced by ultraviolet light after irradiation and optical bleaching to that obtained before irradiation. The behavior of the F-center coloration as a function of time of irradiation under ultraviolet light after exposure of the crystals to high-energy

radiation is different for synthetic and natural sodium chloride. This difference is attributed to the presence of hydroxyl ions in the synthetic crystals which are inadvertently introduced into the lattice during the growth of the crystals in air. The results obtained are the same whether 40-kvp x rays, 2-Mev electrons, or Co^{60} γ rays are used to create the F centers. (auth)

7853

NATURE OF DEFECTS ARISING FROM FAST NEUTRON IRRADIATION OF SILICON SINGLE CRYSTALS. Rohn Truell (Brown Univ., Providence). Phys. Rev. 116, 890-92(1959) Nov. 15.

A method is described for determining the range of sizes that damaged regions created by fast neutrons may have in a silicon single crystal. In particular the use of precision ultrasonic velocity and attenuation measurements for compressional waves together with certain new results from scattering theory permit the determination of an upper and lower limit on the size of a damaged region. The lower limit is determined from the fractional velocity change arising from the irradiation and the upper limit is found from the corresponding attenuation change—or in this case the lack of it. Under the assumption that such regions of damage are spherical the limits obtained lie in a range from 0.01 to 0.27 μ for the radius of the region in question. (auth)

7854

THE EFFECTS OF IRRADIATION ON THE MECHANICAL PROPERTIES OF GRAPHITE. J. H. W. Simmons (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.559-68 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

Data are given on the effect of neutron irradiation on the elastic constants, thermal expansion, and dimensions of several types of graphite. The results are interpreted in terms of the macroscopic structure of graphite by a method which gives some general relations between the properties of the crystal lattice and the properties of the aggregate. It is concluded that the main effects produced by irradiation to a dose less than 2×10^{20} n/cm^2 at 25°C depend on processes which occur in the crystal and that effects at crystal boundaries play a minor part. The conclusions are supported by some observations on the effect of irradiation on the mechanical properties of a crystal of Travancore graphite. The inelastic effects which occur when graphite is irradiated under stress are described and an explanation of them is suggested. (auth)

7855

THE MICROPORE STRUCTURE OF NEUTRON IRRADIATED GRAPHITE. C. N. Spalaris (General Electric Co., Richland, Wash.). p.575-8 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

X-ray-diffraction studies on graphite irradiated in a low temperature (20 to 100°C) environment show a significant crystalline growth or expansion along the c-axis, apparently caused by energetic neutrons. This crystalline expansion was found to be many times greater than the increase in over-all physical length experienced for irradiated graphite. Measurements on the physical expansion of formed graphite samples showed a 0.2 to 0.6% increase upon reactor exposure at a low temperature test position for a total of 7.5×10^{20} nvt. The same samples, however, exhibit a 15% increase in crystalline expansion as determined by x-ray measurements. This phenomenon was attributed to the fact that the individual crystallites, in expanding during irradiation, occupied neighboring empty pore space. (auth)

7856

ELECTRON IRRADIATION OF SOLIDS. A. C. Damask (to U. S. Atomic Energy Commission). U. S. Patent 2,911,533. Nov. 3, 1959.

A method is presented for altering physical properties of certain solids, such as enhancing the usefulness of solids, in which atomic interchange occurs through a vacancy mechanism, electron irradiation, and temperature control. In a certain class of metals, alloys, and semiconductors, diffusion or displacement of atoms occurs through a vacancy mechanism, i.e., an atom can only move when there exists a vacant atomic or lattice site in an adjacent position. In the process of the invention high-energy electron irradiation produces additional vacancies in a solid over those normally occurring at a given temperature and allows diffusion of the component atoms of the solid to proceed at temperatures at which it would not occur under thermal means alone in any reasonable length of time. The invention offers a precise way to increase the number of vacancies and thereby, to a controlled degree, change the physical properties of some materials, such as resistivity or hardness.

PHYSICS

General and Miscellaneous

7857 AD-213033

Oxford Univ. Inorganic Chemistry Lab.

PRODUCTION OF ATOMS USING ELECTRIC DISCHARGES. J. C. Greaves, K. R. Jennings, and J. W. Linnett. Feb. 1959. 19p. Contract AF61(514)-1117.

A chronological account of research in the field of atom production by electric discharges is presented. Satisfactory and unsatisfactory methods are discussed. Experiments with internal electrodes are described along with the development of radiofrequency and microwave maintained discharges. It was concluded that for oxygen and hydrogen at 0.1 mm Hg or less, radiofrequency radiation is preferable to microwaves for discharge maintenance. For pressures greater than 10 mm, microwaves may be better; however, no data on atom production at such pressures were obtained. (J.R.D.)

7858 AD-219506

Space Technology Labs., Inc., Los Angeles.

PULSE HEIGHT DISTRIBUTION OF ČERENKOV COUNTERS. I. GEOMETRICAL PATH LENGTH DISTRIBUTION. Richard J. Wagner. June 1, 1959. 43p. (TR-59-0000-00720).

The problem of determining the distribution of path lengths of an isotropic flux of particles passing through a cylinder is solved analytically. The distribution function is shown graphically for cylinders of various height to diameter ratios, and the mean path length is calculated in each case. The distribution function for some special cases of shielded cylinders is also discussed. (auth)

7859 AD-219784

Stanford Research Inst., Menlo Park, Calif.

INTERACTION OF ELECTRON AND ION BEAMS WITH METASTABLE SUBSTANCES. Final Report. Charles J. Cook and Harold J. Eding. Jan. 22, 1959. 58p. SRI Project No. SU-2394. Contract DA-44-009-ENG-3426.

A summary is presented of the research on growth of good alpha lead azide crystals. One and two mm crystals were grown; however, the minimum acceptable length is 4 mm. Since these crystals are not available in quantity, it

was decided to study the interaction of slow electrons with alkali halides from which a firm base can be established to provide reasonable interpretation of minimum data observed with α $Pb(NO_3)_2$. Reliable data were collected on surface absorption of slow electrons by KCl, and tentative identifications of certain adsorption coefficient structure with F center absorption, V centers, dissociation, conduction band energy gap width, colloidal particle absorption, and vacuum level were made. (J.R.D.)

7860 AD-226072
Wayne State Univ., Detroit.
THE DETERMINATION OF SIZE DISTRIBUTION CURVES BY LIGHT SCATTERING AND RELATED INVESTIGATIONS. Technical Report No. 34. Morton L. Wallach. Aug. 1, 1959. 92p. Project No. 051-380. ONR Contract 736(00).

An investigation was undertaken in an effort to develop a method of determining particle size distribution curves in emulsions. Most of the conventional, well established methods of determining size distribution curves are not particularly suited to the analysis of emulsions. In contradistinction, light scattering should in principle be well adapted to the study of size distributions in emulsions. In general, a measurable contribution is made to the total observed effect even for very small colloidal particles. Five per cent differences in size can be detected for particles as small as 100 mμ in diameter. Experimental techniques established for mono-dispersed systems should serve equally as well in the case of heterodispersions. Moreover, the system under investigation would not be altered by the measurements. (W.L.H.)

7861 AECU-4632
Picker X-Ray Corp. Picker Research Center, Cleveland.
RADIOISOTOPE X-RAY GENERATOR. Quarterly Progress Report No. 2 Covering the Period from October 1, 1959 to December 31, 1959. M. W. Chisholm, R. J. Lambert, and Jacob Kastner. 20p. Contract AT(11-1)-746. OTS.

An electromagnetic quadrupole lens system was developed for use in study of beta ray focusing. A current-carrying wire analog was also developed to make preliminary studies of the necessary lens parameters. (auth)

7862 AECU-4650
Oak Ridge National Lab., Tenn.
THE DESIGN AND USES OF HIGH FLUX RESEARCH AND TEST REACTORS. J. A. Lane. [1959]. 39p. Contract [W-7405-eng-26]. OTS.

For presentation at the Conference on High Flux Testing Reactors, Mol, Belgium, Sept. 21-25, 1959.

The need for thermal and fast neutron fluxes in the range of 1 to 5×10^{15} neutrons/cm^2(sec) for the production of heavy elements such as Cf^{252} and other special isotopes and for improving the quality of beam experiments, reactor materials testing work, and solid state research has led to plans for the construction of three ultra high flux research reactors. The designs of these and other high flux research reactors are based on the general technology of enriched tank-type reactors; however, they utilize the principle of separate fuel and moderator regions to achieve flux peaking in these regions. Thus, proposed designs take the form of an annular fuel region with internal and external moderating regions or an undermoderated core with an external moderator or reflector. In such arrangements, the thermal flux peaks in the moderating regions and the fast flux peaks in the fuel region, which results in maximum fast and thermal fluxes per unit of power. Since most of the moderation of fast neutrons takes place outside of the fuel region, the thermal flux peaking depends on the number of fast neutrons leaking from the reactor core, which in turn depends on the power density in the core. Thus, maximum fluxes of neutrons at all energy levels are proportional to the power density in the reactor core. Interest in high flux reactors, therefore, has led to a consideration of ways in which the power density in the reactor core, and thereby the flux, may be increased. (auth)

7863 AERE-R-3134
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A MERCURY COMPUTER PROGRAM FOR TWO-DIMENSIONAL LEAST SQUARE CRYSTALLOGRAPHIC REFINEMENT. A. R. Curtis. Dec. 1959. 26p. BIS.

A Mercury computer program for least square refinement of crystal structures in two-dimensional projection is described, and notes on its use are given. This is the definitive version of a program which has been in use for about a year at Harwell and elsewhere and has proved popular with crystallographers. It allows simultaneous refinement of up to 85 parameters, including anisotropic thermal vibration parameters if desired, of a structure with up to 31 atoms in the asymmetric unit. About 500 data planes are allowed in the (h k 0) zone. Ouput is flexible and is suitable for re-input to the same program or to a well-known Fourier synthesis program, as appropriate. All plane symmetry-groups can be treated, and all special positions can be handled. Data preparation has been made simple. (auth)

7864 AFCRC-TN-59-473
Stanford Research Inst., Menlo Park, Calif.
A FEASIBILITY STUDY: SCATTERING OF ELECTRONS BY IONS, ATOMS, AND MOLECULES. Scientific Report No. II. Donald C. Lorents and Charles J. Cook. Sept. 17, 1959. 27p. SRI Project No. SU-2555. Contract AF19 (604)-3475. (AD-226316).

The experimental determination of electron differential scattering cross sections is considered in the light of recently developed experimental techniques. A high intensity ion source operated in conjunction with a charge exchange cell can provide, in the form of a fast (0.1 to 5.0 kev) beam, a large variety of scattering media. The density of such beams is low but the use of modern vacuum techniques together with modulation of both the atom beam and the electron beam allows selection of desired scattering events from a host of background events. Low dispersion electron beams with energies down to 1 ev obtained from an SRI-developed electron gun will allow detailed investigation of the low energy region. A measurement of the differential elastic scattering cross section of 1 to 10 ev electrons from atomic oxygen and nitrogen appears feasible with these techniques. The techniques should be applicable to the study of a broad field of low energy electron interactions with atomic systems. (auth)

7865 AFOSR-TN-59-13
California Inst. of Tech., Pasadena. Guggenheim Aeronautical Lab.
MAGNETOHYDRODYNAMIC WAVES. Julian D. Cole. Jan. 1959. 31p. Contract AF49(638)-476. (AD-208594).

Shock waves in an infinitely conducting fluid are studied by means of an idealized piston problem. Switch-on waves are shown to be associated with the discharge of a current sheet. The effect of finite conductivity is studied for both ordinary and switch-on waves. It is shown how current sheets are diffused about the wave front. The effects of non-linearity are discussed in a qualitative way. (auth)

7866 AFOSR-TN-59-1221

Avco Corp. Avco-Everett Research Lab., Everett, Mass.

ON THE FLOW OF A VISCOUS ELECTRICALLY CONDUCTING FLUID. Research Report 73. Harvey P. Greenspan. Oct. 1959. 34p. Contract AF49(638)-61.

The magnetohydrodynamic flow of a viscous incompressible fluid of constant properties past a flat plate is investigated. The applied magnetic field is parallel to the free stream direction and the plate is at zero angle of attack. A number of explicit solutions of the linearized theory are presented for the flow past a semi-infinite plate which is either sucking or injecting a conducting fluid into the main stream. Unlike the case of super-Alfvén flow (where the free stream velocity is greater than the Alfvén wave speed) no solution exists in the problem of sub-Alfvén flow past a semi-infinite flat plate which is either impermeable or injecting fluid. Special solutions do exist for certain values of the suction velocity. The sub-Alfvén flow past a long finite impermeable plate is studied in some detail and the magnitude of the viscous wake is compared to the similar type upstream disturbance produced by the forward propagation of Alfvén waves. In the case of infinite conductivity, it is found that the upstream disturbance is approximately one plate length long measured from the leading edge. In connection with the super-Alfvén flow past a semi-infinite plate which is injecting a fluid whose conductivity differs from that of the main stream, the inadequacies and failures of the linearized theory are discussed. (auth)

7867 BAW-1084

Babcock and Wilcox Co. Research Center, Alliance, Ohio.

LIQUID METAL FUEL REACTOR EXPERIMENT. SIXTY-CYCLE INDUCTION HEATING OF CROLOY 2-1/4 PIPING. F. H. Kaltenbach. Oct. 1959. 57p. OTS.

Croloy $2\frac{1}{4}$ piping of various shapes and sizes was tested to determine the feasibility of 60-cycle induction heating. Various heating coil arrangements showed power factors of more than 50% and efficiencies of more than 80%. Therefore this method of heating is considered feasible and practical. (auth)

7868 CEA-1055

France. Commissariat à l'Énergie Atomique, Paris.

EXPERIENCE EXPONENTIELLE SUR UN RESEAU URANIUM–GRAPHITE. (Exponential Experiment on a Uranium–Graphite Lattice). J. Leroy and J. Martelly. Dec. 1958. 28p.

An exponential experiment on a natural uranium and graphite lattice is described. The critical buckling for a cubic pile made with this lattice is $B^2 = 0.726 \pm 0.011$ m^{-2} and the anisotropy $\alpha = (B_L^2/B_T^2)$ is 0.987 ± 0.006. The behavior of the neutron density in the lattice near the reflector and sources is discussed in detail. (auth)

7869 CF-58-10-21

Oak Ridge National Lab., Tenn.

PRELIMINARY DESIGN REPORT FOR THE NMSR PRESSURIZED WATER LOOP AT ORR. I. T. Dudley, D. B. Trauger, and H. W. Savage. Oct. 23, 1958. 41p. OTS.

The design criteria, description, flow diagrams, and some drawings of a pressurized water loop in which reactor operation conditions can be simulated are presented. The primary purpose of this test facility is irradiation testing of various versions of fuel elements for use in the Merchant Ship Reactor Program. The loop proper is designed for operation at 625°F and 2250 psi with a water flow rate of 90 gpm. Heat exchanger capacity is 150 kw at 300°F system water temperature. Loop construction is of 300 series stainless steels throughout. A by-pass purification system provides for continuous water chemistry control. Fuel pin specimens are to be irradiated in the space provided by two tubes, 1.5 ID × 24 in. long, of the "hairpin" type in positions A1 and A2 of the ORR core. The average unperturbed neutron flux at this point in the reactor is estimated to be 5×10^{13} thermal. (auth)

7870 CF-60-1-46

Oak Ridge National Lab., Tenn.

EGCR COOLANT PURIFICATION. TREATMENT OF BUFFER HELIUM FROM WATER OR OIL SEALS. P. A. Haas and C. D. Scott. Jan. 25, 1960. 11p. OTS.

For removal of seal fluid from the buffer helium stream from EGCR blowers or compressors, separate treatment from that of a bypass stream for chemical purification appears desirable. The choice between oil and water as the seal fluid will not greatly affect the design or operation of the system unless use of one of the fluids results in a reduction of the buffer helium flow. The design of entrainment separators and cooler condensers and the selection of a seal oil are discussed. (auth)

7871 CF-60-1-67

Oak Ridge National Lab., Tenn.

PROTECTION OF SPACE VEHICLES FROM METEORITE PENETRATION. R. J. Hefner and P. G. Lafyatis. Jan. 20, 1960. 28p. OTS.

Thin bumpers were proposed as a means of protecting a space vehicle from penetration by meteorites. Equations for the determination of the bumper thickness, the minimum spacing from the vehicle, the bumper temperature, and the effect of the bumper on the thermal performance of a space radiator were developed as functions of the duration of space flight, the surface area, temperature and wall thickness of the vehicle, and the physical properties of the bumper and vehicle wall materials. Curves were prepared for the design of a transparent bumper for the protection of a space vehicle. (auth)

7872 CF-60-1-109

Oak Ridge National Lab., Tenn.

EFFECT OF TEMPERATURE ON RADIATOR WEIGHT FOR SPACE VEHICLE POWER PLANTS. P. G. Lafyatis. Jan. 26, 1960. 6p. OTS.

The effect of temperature on the weight of a space radiator is somewhat obscured since the change in temperature of the radiator will change the area of the radiator which will in turn affect the vulnerable area and the radiator thickness. An analysis was carried out in an attempt to see what the effect of increasing the over-all system temperature might have on the radiator specific weight if meteoroid protection is considered. (auth)

7873 CX-34

New York Univ., New York. Inst. of Mathematical Sciences.

THE APPLICATION OF THE IMPULSE APPROXIMATION TO THE INELASTIC SCATTERING OF ELECTRONS BY HYDROGEN ATOMS. Richard Akerib and Sidney Borowitz. July 1958. 43p. Contract AF19(604)-1705. (AFCRC-TN-58-283).

A calculation of the ionization cross section and the excitation cross section to the 2S and 2P states of hydrogen by collision with electrons is carried through, using an impulse approximation. The results are then compared to the experimental results when available and to the various theoretical calculations. The cross sections obtained compare favorably with experiment except for the excitation to the 2S state. The calculations carried out by these methods are considerably simpler than the usual approximation methods, and the agreement of the results with experiment

indicates that it is a simpler and better method to use for the computation of cross sections in the scattering of electrons by atoms. (auth)

7874 CX-39

New York Univ., New York. Inst. of Mathematical Sciences.

EFFECTIVE TWO-BODY METHOD FOR TWO-ELECTRON ATOMS. S. I. Rubinow. Feb. 1959. 20p. Contract AF19(604)-4555. (AFCRC-TN-59-239; AD-211159). OTS.

The possibilities of obtaining approximate solutions of the bound two-electron atomic system by an effective two-body method were studied. The method consists essentially of the assumption of a simple functional form for the wave function. The resulting Schroedinger equation may be solved exactly, yielding upper bounds of all the eigenvalues of the system. Only the lowest approximate eigenvalue is near to the exact result. Methods of improvement are suggested and discussed. (auth)

7875 CX-41

New York Univ., New York. Inst. of Mathematical Sciences.

THE APPLICATION OF WAVE FUNCTIONS CONTAINING INTERELECTRON COORDINATES. I. THE GROUND STATE ENERGY OF LITHIUM. Peter Walsh and Sidney Borowitz. Apr. 1959. 61p. Contract AF19(604)-4555. (AFCRC-TN-59-252; AD-217189). OTS.

This report treats the description of atomic systems by the novel method of introducing interelectron coördinates explicitly. The simplest atomic systems, helium and lithium, are treated and excellent results are found in calculating the energy values of the corresponding ground states. In addition, an approximation technique of high accuracy has been developed to handle, mathematically, wave functions containing many interelectron coördinates. (auth)

7876 GA-632

General Atomic Div., General Dynamics Corp., San Diego, Calif.

IONIZATION OF ATOMIC AND MOLECULAR OXYGEN ON ELECTRON IMPACT. W. L. Fite and R. T. Brackmann. Mar. 1959. 15p. Contract AF49(638)-356. (AFOSR-TN-59-18; AD-208599).

A method is described for measuring the cross section for ionization of the oxygen atom on electron impact and the cross section for the production of the O_2^+ ion when an electron strikes an oxygen molecule. (W.D.M.)

7877 GA-1168

General Atomic Div., General Dynamics Corp., San Diego, Calif.

RECOMBINATION AND ATTACHMENT IN IONIZED GASES. V. A. J. van Lint. Aug. 1959. 67p. Project No. 7811. Contract AF29(601)-1225. (AFSWC-TR-59-43).

An experimental program is described in which the recombination and attachment of electrons in ionized gases were measured. Oxygen and mixtures containing oxygen received most attention. The experiment was performed by producing some ionization in the sample gas and observing the rate of decrease of the electron density subsequent to the ionizing event. Ionization was produced by 20-Mev electrons. The electron density was measured by observing the attenuation and phase shift of an x-band microwave passed through the ionized gas. The rate of electron density decrease was interpreted in terms of attachment, recombination, and diffusion of electrons. (J.R.D.)

7878 HE-150-168

California. Univ., Berkeley. Inst. of Engineering Research.

THEORY OF THE STAGNATION POINT LANGMUIR PROBE. L. Talbot. Mar. 30, 1959. 34p. Contract AF49(638)-502. (AFOSR-TN-59-474; AD-215717).

The theory of the Langmuir probe is developed, and it is shown how measurements made with such a probe can be used to determine free stream ion concentrations and temperatures in a supersonic plasma jet. (W.D.M.)

7879 HW-49444

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FADING EFFECT IN EASTMAN NTA EMULSION. E. C. Watson. Mar. 29, 1957. 5p. OTS.

The fading effect in NTA emulsions used for monitoring personnel exposed to fast neutrons has been measured. For the energy spectrum used in calibration, it was found that a delay of 21 days in developing results in a loss of 25% of the tracks. (auth)

7880 HW-59691

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

EFFECTS OF IN-REACTOR TEST LOOPS ON PRTR OPERATION AND PROGRAM. R. E. Peterson. Mar. 18, 1959. 15p. Contract W-31-109-Eng-52. OTS.

An analysis of the effects of test loops in the PRTR reactor core on reactivity, program schedules, physics analysis and data, and reactor safety and operation is presented. Final design of the proposed loops is not complete, and the analytic methods to be used for fuel cycle studies are not finally established. For these reasons the information and conclusions are regarded as preliminary. (J.R.D.)

7881 HW-61181

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NUCLEAR PHYSICS RESEARCH QUARTERLY REPORT [FOR] APRIL, MAY, JUNE 1959. July 20, 1959. 58p. Contract AT(45-1)-1350. OTS.

The usual procedure for calculating relative reaction rates in a heterogeneous reactor lattice of parallel fuel elements is to cylindricize a unit cell and then use some approximation to transport theory to determine the neutron flux in each region. However, if one attempts to treat a non-uniform array, such as a reactor containing control rods, by such a method, the additional complication of homogenizing the materials of the cell into various regions is present. Within the range of validity of small source theory, one can formulate a critical condition for such a system eliminating the need for calculating effective parameters for a homogenized model. Such a formulation is presented. Kottwitz's treatment of thermal flux near a temperature discontinuity is extended by adding a net neutron current perpendicular to the interface. The vernier chronotron is a multichannel instrument to measure time intervals in the nanosecond region. The performance of a new model is compared with the original. An experimental investigation of the energy and space distribution of thermal neutrons in the vicinity of a temperature discontinuity in graphite is described. The analytical methods employed and values of the neutron rethermalization properties of graphite are discussed. Three sets of reactivity coefficient measurements were analyzed to yield the absorption cross section of nitrogen for thermal neutrons. The infinite medium thermal neutron multiplication factor and "1/v" utilization were determined in the PCTR for a 7-rod cluster of natural uranium rods in a 10.5-inch square graphite lattice. Values were determined with both air and water coolant. The program of measuring the critical mass of 3.063% enriched U rods in H_2O by critical approach techniques was continued. (For preceding period see HW-60220.) (W.D.M.)

7882 KAPL-M-WBW-1

Knolls Atomic Power Lab., Schenectady, N. Y.

A SURVEY OF SMALL CORE HYDROGEN MODERATED REACTORS. W. B. Wright, Jr. Aug. 31, 1955. Decl. Jan. 4, 1960. 15p. Contract W-31-109-Eng-52. OTS.

A survey was made of small-core, hydrogen-moderated, sodium-cooled reactors. Zirconium hydride was employed as a source of hydrogen moderator and was mocked in the critical assembly by a mixture of polyethylene and Zr metal. All the reactors in the group were Be-reflected and were contained within a stainless steel blanket. An account is presented of an investigation of the spectrum, fission rate distributions, and reactivity coefficients as a function of fuel to moderator ratio and core geometry. (C.H.)

7883 ML-571

Stanford Univ., Calif. Microwave Lab.

RADIATION FROM RELATIVISTIC ELECTRONS. OBJECT 1: STUDY OF POSSIBLE TECHNIQUES FOR UTILIZING RELATIVISTIC ELECTRONS TO PRODUCE ELECTROMAGNETIC OSCILLATIONS AT SUBMILLIMETER WAVELENGTHS. OBJECT 2: STUDY OF THE FEASIBILITY OF A SOLID-STATE, TWO-LEVEL, HIGH-POWER MASER. Quarterly Progress Report No. 10 [for] September 15—December 15, 1958. Kenneth B. Mallory and H. John Shaw. Jan. 1959. 14p. DA Project No. 3-99-13-022. Contract DA-36-039-SC-72785. (AD-216390)

A trial design for a new buncher has been completed. A computer study is under way to determine appropriate corrections to the trial design. The new buncher will be in service next spring. The present prebuncher cavity improved bunching such that the 8th harmonic was detected. The grating spectrometer was designed and tested. The program of the solid-state maser is to investigate the feasibility of obtaining microwave and millimeter-wave radiation from free precessions in a ferromagnetic material excited by a pulsed d-c magnetic field. Developments during the past quarter resulted in several changes in the experiments. Highly polished spheres of yttrium iron garnet single crystals are being considered as the active element. Present pulsed magnetic field characteristics appear adequate for the purpose. (auth)

7884 ML-594

Stanford Univ., Calif. Microwave Lab.

RADIATION FROM RELATIVISTIC ELECTRONS. OBJECT 1: STUDY OF POSSIBLE TECHNIQUES FOR UTILIZING RELATIVISTIC ELECTRONS TO PRODUCE ELECTROMAGNETIC OSCILLATIONS AT SUBMILLIMETER WAVELENGTHS. OBJECT 2: STUDY OF THE FEASIBILITY OF A SOLID-STATE, TWO-LEVEL, HIGH-POWER MASER. Quarterly Progress Report No. 11 [for] December 15, 1958—March 15, 1959. Kenneth B. Mallory and H. John Shaw. Apr. 1959. 17p. DA Project No. 3-99-13-022. Contract DA-36-039-SC-72785. (AD-219346)

The electrical design of a new buncher was completed. A test section was built to aid in determining the proper mechanical design of the buncher. A cavity with adjustable coupling was tested. It appears to have a field distribution differing slightly from the pure TM_{01n} mode desired. Reasonably large signals were obtained at 5.4 mm from a sinuous waveguide ("Purcell radiator") and at 4.1 mm from a magnetic undulator. Several single-crystal yttrium iron garnet spheres were produced with diameters of approximately 30 mils, and having a measured line width of approximately 1 gauss. This corresponds to a relaxation time of about 100 millimicroseconds, which is quite satisfactory for use with the present pulsed-field apparatus. An r-f coupling system was constructed for extracting S-band energy from the garnet sample. Further improvement was obtained in the generation of pulsed magnetic fields, both the rise time and the field strengths being suitable for the initial S-band experiments. (For preceding period see ML-571.) (auth)

7885 NAA-SR-3923

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

TRANSIENT BUBBLE GROWTH IN A HOMOGENEOUS REACTOR. H. P. Flatt. Jan. 15, 1960. 33p. Contract AT-11-1-GEN-8. OTS.

A mechanism for shutting off a power excursion in a homogeneous reactor by the rapid formation of bubbles was investigated. Equations are derived which give upper and lower bounds for the radius of a bubble, as a function of time, under conditions present in a reactor. Deduction of the bubble nuclei growth rate from observations of void volume and pressure can be made. (auth)

7886 NAA-SR-4457

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

AN EXTENSION OF SMALL SOURCE THEORY TO INCLUDE EPITHERMAL FISSION. J. W. Zink. Jan. 15, 1960. 13p. Contract AT-11-1-GEN-8. OTS.

The application of small source theory to thermal reactors is modified to include the effects of epithermal fission. The effects of epithermal fission are found to be to increase the effective number of neutrons produced per thermal neutron absorbed in the fuel and to decrease the probability of a neutron escaping capture during its slowing down period. (auth)

7887 NAA-SR-Memo-2902

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

EFFECT OF TEMPERATURE UPON THE ENERGY ABSORPTION IN THE ORGANIC [MODERATOR-COOLANT] IN THE OMRE. V. Keshishian. July 16, 1958. 6p. OTS.

Investigations were conducted to determine the effects of temperature on the energy absorption of the moderator-coolant in the OMRE. Results of calculations performed to determine the energy absorbed by the organic moderator-coolant at 500, 550, 600, and 700°F are given. (J.R.D.)

7888 NAA-SR-Memo-3245

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ENERGY ABSORPTION IN THE COOLANT OF A 555 Mw THERMAL OMR. V. Keshishian. Nov. 13, 1958. 5p. OTS.

An investigation to determine the fraction of total fission energy absorbed by the organic coolant in a 555-Mw OMR operating at full power with a bulk coolant temperature of 585°F is described. The calculated fraction was 4.00%. (J.R.D.)

7889 NP-8171

Denmark. Atomenergikommissionen, Copenhagen.

ATOMENERGIPROBLEMER: FIRE FOREDRAG VED ET MØDE FOR ERHVERVSLIVETS LEDERE, RISØ, 22, OKTOBER 1959. [1.] OM ATOMENERGIENS STILLING I DAG. [2.] REAKTORFORSKNING PÅ RISØ. [3.] VURDERINGEN AF EN REAKTORS SIKKERHED. [4.] REAKTORTEKNIKKENS INDFLYDELSE PA ANDRE INDUSTRIELLE OG VIDENSKABELIGE OMRADER. (Atomic Energy Problems: Four Lectures given at a Meeting for Industrial Leaders, Risø, October 22, 1959. [1.] Position of Atomic Energy Today. [2.] Reactor Research at Risø. [3.] Appraisal of Reactor Safety. [4.] Effects of Reactor

Developments on other Industrial and Scientific Fields). T. Bjerge, P. L. Ølgaard, O. Kofoed-Hansen, J. Thomas, and F. Juul. 48p.

7890 NP-8219
Battelle Institut e. V., Frankfurt am Main.
THEORETICAL INVESTIGATION AND DESIGN STUDIES FOR THE EVENTUAL CONSTRUCTION OF A MEASURING DEVICE IN THE FIELD OF PLASMA ELECTRONICS. Annual Report No. 1 [for] Period from December 1, 1958 to November 30, 1959. Dec. 31, 1959. 22p. Contract DA-91-591-EUC-1018 OI-1165-59.

An electromagnetic wave penetrating the ionosphere will change both its propagation direction and its propagation velocity as a function of its frequency compared to the propagation in vacuum. This results in errors in the angular and range measurements in the location of bodies, regardless of whether these measurements are based on transit time measurements or Doppler shift measurements. Experimental and theoretical investigations on the clarification of these relations and the correction of the angle and range errors are summarized. (W.D.M.)

7891 NP-8260
Pennsylvania State Univ., University Park. Spectroscopy Lab.
TECHNICAL REPORT FOR THE PERIOD JULY 1, 1958–JANUARY 1, 1960. 113p. Contract Nonr-656(12).

Seven papers are presented on infrared wavelength measurements, pressure shifting of lines, and molecular constants. Separate abstracts have been prepared for each. (W.D.M.)

7892 NP-8260(Paper 1)
Pennsylvania State Univ., University Park.
MOLECULAR CONSTANTS OF CARBONYL SULFIDE AND A CORIOLIS PERTURBATION. G. D. Saksena, T. A. Wiggins, and D. H. Rank. 13p.

The band origins and the changes in B and D for five bands of carbonyl sulfide were measured. The highly precise values obtained are the result of precise infrared measurements used in conjunction with microwave results. The changes in B for the 002 and 003 bands agree with the reported value of α_3 from microwave measurements. The other bands, members of resonating polyads, have anomalous values of ΔB. The ΔD values also reflect this resonance. A Coriolis rotational perturbation in the 003 band was observed and analyzed. (auth)

7893 NP-8260(Paper 2)
Pennsylvania State Univ., University Park.
A 5 METER VACUUM SPECTROMETER FOR THE NEAR INFRARED. D. H. Rank, G. D. Saksena, G. Skorinko, D. P. Eastman, T. A. Wiggins, and T. K. McCubbin, Jr. 18p.

A vacuum spectrometer capable of obtaining resolution approaching the maximum theoretical resolution of a seven-inch diffraction grating doubly passed was constructed for use in the region of sensitivity of lead sulfide photoconductive cells. The design and construction of the instrument and its performance in the resolution of spectral details and the measurement of wavelengths are discussed. (auth)

7894 NP-8260(Paper 3)
Pennsylvania State Univ., University Park.
HIGHLY PRECISE WAVELENGTHS IN THE INFRARED. D. H. Rank, George Skorinko, D. P. Eastman, and T. A. Wiggins. 17p.

A critical survey of the wavelength measurements made in this laboratory during the past few years was performed. The data obtained for certain selected absorption bands were analyzed and all band lines were computed making use of the molecular constants derived from the measurements. (W.D.M.)

7895 NP-8260(Paper 4)
Pennsylvania State Univ., University Park.
VIBRATION-ROTATION SPECTRA OF HCN. D. H. Rank, G. Skorinko, D. P. Eastman, and T. A. Wiggins. 46p.

An analysis of the spectrum of the linear unsymmetric molecule $HC^{12}N$ was made permitting the determination of the 21 constants necessary for predicting the vibrational frequencies and the 10 constants necessary for predicting the B value for the various vibrational states. To determine these constants new measurements were made on numerous bands in the region of $1-3\,\mu$ employing a 5 meter vacuum spectrograph. Several instances of Fermi resonance were detected and analyzed. Except for a few bands where additional resonances may be present the vibrational constants predict the measured values for the band origins of 44 bands within an amount not much greater than the expected experimental error. The rotational constants also predict the B value within the experimental error for 24 bands where data are available. (auth)

7896 NP-8260(Paper 5)
Pennsylvania State Univ., University Park.
PRECISION MEASUREMENT OF THE WAVELENGTHS OF INFRARED ABSORPTION LINES WITH DIFFRACTION GRATINGS. D. H. Rank. 8p.

The use of modern diffraction gratings and photoconducting detectors makes possible the measurement of the wavelengths of infrared absorption lines to a precision amounting to a small fraction of the Doppler breadth of the lines themselves. The main difficulties encountered in making measurements to this precision seem to be in the scanning and interpolation procedures plus displacement errors arising from inexact superposition of known wavelengths on the spectrum to be measured. Making use of absorption lines as standards and a single light source eliminates displacement errors. Proper scanning techniques can reduce interpolation errors to insignificance. Coarse blazed gratings of very high degree of perfection are now available. Making use of the method of coincidences in high orders such gratings can be used to effectively multiply the small number of accurately measured absorption lines available, so that only short interpolations between standard lines are necessary throughout the 1 to $4\,\mu$ region. (auth)

7897 NP-8260(Paper 6)
Pennsylvania State Univ., University Park.
PRESSURE INDUCED SHIFTS OF HCl LINES DUE TO FOREIGN GASES. D. H. Rank, W. B. Birtley, D. P. Eastman, and T. A. Wiggins. 6p.

The pressure shifting of the R(10) and R(0) lines of the 2-0 band of HCl^{35} was measured by making use of He, Ne, H_2, Ar, O_2, N_2, CO, CO_2, and N_2O as the foreign gases. The measured pressure shifts are given. A one meter absorption tube was used to make the measurements, and the HCl pressure employed was 2.5 cm of Hg or less. (W.D.M.)

7898 NP-8260(Paper 7)
Pennsylvania State Univ., University Park.
PRESSURE SHIFTING OF SPECTRUM LINES, SOME EMPIRICAL GENERALIZATIONS. D. H. Rank, W. B. Birtley, D. P. Eastman, and T. A. Wiggins. 5p.

Results are displayed which show that the magnitude of the foreign gas shifts observed for the 21 cm line of atomic hydrogen, the R(10) line of the 2-0 band of HCl,

and the resonance line of Hg are proportional to the frequency over a frequency range of 10^6 and probably proportional to the optical polarizability of the foreign gas. (W.D.M.)

7899 NP-8287

Louisiana State Univ., Baton Rouge. Engineering Experiment Station.

A LITERATURE SURVEY OF THE THERMAL CONDUCTIVITY OF LIQUIDS. Byron C. Sakiadis and Jesse Coates. 1952. 73p.

Available as Louisiana State Univ., Eng. Expt. Sta. Bull. No. 34.

A survey of experimental measurement methods for thermal conductivity of liquids is presented. The reliability of available results is evaluated. Experimental work prior to 1923 is summarized briefly followed by a section comprising abstracts of the latest research and a section containing data on the thermal conductivities of pure organic and inorganic liquids. Each section has a bibliography and author index. (J.R.D.)

7900 NP-8291

Iowa State Coll., Ames.

FAST AND THERMAL NEUTRON FLUXES IN A GRAPHITE MODERATOR (thesis). Ralph Richard Hedges. 1959. 83p. OTS.

The fast and thermal neutron fluxes throughout the U graphite-moderated subcritical assembly constructed at the Iowa State College were determined. This assembly with the fuel removed consisted of a rectangular parallelepiped of graphite moderator with an external fast neutron source. This moderating system is essentially a "sigma pile" with holes interspersed at regular intervals. (W.L.H.)

7901 NP-8303

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

GENERAL MODEL FOR A SEMI-INFINITE TRANSMISSION LINE WITH MUTUAL INDUCTANCE. Richard H. Huddleston. Oct. 2, 1959. 19p. Contract AF04(647)-309.

Equations are formulated for a transmission line in which mutual inductance effects are important. For a semi-infinite line the equations are of a generalized Wiener-Hopf type. The techniques necessary to solve problems associated with such a line are developed. The principal result is an integral representation for the solution of the equations corresponding to prescribed initial conditions and a given terminating impedance. (auth)

7902 NP-8310

Carnegie Inst. of Tech., Pittsburgh.

VELOCITY DISTRIBUTIONS IN DIRECT AND REFLECTED ATOMIC BEAMS. Technical Report No. 1. J. H. McFee and P. M. Marcus. Jan. 8, 1960. 170p. Contract Nonr-760(11).

Extensive and accurate measurements were made of the velocity distributions in potassium atomic beams emerging directly from an oven. At low source (oven) pressures, the distributions were found to be highly Maxwellian and were characterized by temperatures which corresponded closely to the measured source temperatures. At high source pressures (mean-free-path in source ≅ source slit width) the velocity distribution in the beam was found to be substantially deficient in low velocity atoms, as compared to the Maxwellian prediction. In an attempt to investigate the details of the interaction of gases with solid surfaces, this atomic beam, whose properties are known from the measurements first described, was scattered (reflected) from various solid surfaces and the velocity distribution of the scattered atoms was measured. The surfaces investigated included polycrystalline Cu, W, and Au, and cleavage planes of MgO and LiF single crystals. Surface temperatures ranged from 500 to 2100°K. In the case of the Cu, W, Au, and MgO surfaces, the velocity distributions of the reflected beams were found to be highly Maxwellian. The temperatures of the reflected-beam distributions apparently corresponded closely to the surface temperatures, although only in the case of the Cu surface was an accurate and independent measurement of the surface temperature possible. The exchange of energy between the atomic beam and these surfaces was, therefore, essentially complete. The reflection of K atoms from the cleaved LiF surface was anomalous. The reflected-beam velocity distribution was definitely non-Maxwellian, and the energy exchange between the beam and the surface was found to be incomplete (approximately 70% of the maximum possible) for surface temperatures between 600 and 900°K. (auth)

7903 NP-8315

North Carolina State Coll., Raleigh.

TABLES OF SERIES COEFFICIENTS FOR BURNUP FUNCTIONS. Raymond L. Murray and Lawrence A. Mink. May 1959. 83p.

Available as N. Carolina State Coll. Dept. of Eng. Research Bull. No. 71, $1.50.

The calculation of nuclear reactor properties under condition of long-term operation is greatly facilitated by the use of the burnup functions. Tables of series coefficients that allow the rapid evaluation of the burnup functions are presented. The parameter x is essentially a product of microscopic absorption cross section of an absorbing fuel or poison and the time integral of the neutron flux amplitude. (W.L.H.)

7904 ORNL-2883

Oak Ridge National Lab., Tenn.

SAMPLE SCATTERING CORRECTIONS IN NEUTRON BEAM EXPERIMENTS. H. W. Schmitt. Jan. 28, 1960. 21p. Contract W-7405-eng-26. OTS.

Calculations were made of the effects of single and multiple neutron scattering in a disk of sample material. These effects increase the effective thickness of the sample relative to the geometric thickness in the direction of the incident neutrons and must be considered in a large class of neutron measurements, e.g., cross section measurements in which the total number of reactions in a sample is measured. The integrals, taking account of exponential attenuation, were evaluated for neutron beams incident along the axis of the disk. Results are given analytically and graphically. (auth)

7905 ORNL-2887

Oak Ridge National Lab., Tenn.

MEASUREMENT OF ELECTRON ATTACHMENT IN OXYGEN–METHANE AND OXYGEN–CARBON DIOXIDE MIXTURES. L. B. O'Kelly, G. S. Hurst, and T. E. Bortner. Jan. 25, 1960. 75p. Contract W-7405-eng-26. OTS.

The formation of heavy negative ions by the attachment of low-energy electrons to oxygen molecules was studied for small amounts of oxygen mixed with methane or carbon dioxide. The rate of attachment in both cases was found to depend on the electron energy, the pressure of the oxygen and the non-attaching gas, and on the kind of non-attaching gas. In general, the attachment increases as electron energy decreases or as either oxygen or total pressure increases. The value of the attachment coefficient in oxygen–carbon dioxide mixtures is about 100 times its value in oxygen–methane mixtures. This large difference is probably due in part to differences in electron energy and partly

to differences in the stabilizing qualities of the two molecules. Dissociative attachment, which should be pressure independent, does not occur at the low energies that were used in this work. Both methane and carbon dioxide are sometimes used as filling gases for Geiger and proportional counters. The high sensitivity of carbon dioxide to oxygen contamination indicates that very pure gas should be used if the best operation is to be obtained. The low sensitivity of methane recommends it for counters where careful purification of the gas is difficult and particularly for flow counters where the possibility of contamination by atmospheric oxygen exists. (auth)

7906 R59SD414

General Electric Co. Missile and Space Vehicle Dept., Philadelphia.

ANALYTICAL WAVE FUNCTION. III. THE SPIN-ORBIT, SPIN-OTHER ORBIT AND SPIN-SPIN INTERACTIONS. R. G. Breene, Jr. Oct. 20, 1959. 20p.

In two earlier papers methods and programs for calculations of certain classes of atomic wave functions were described. The application of the wave functions so obtained to the calculation of the spin-orbit, spin-other orbit, and spin-spin interactions is considered. These calculations remove the horizontal degeneracy from the Slater diagram. The Coulomb potential for the spin-orbit calculation is assumed, and the relative contributions of the nucleus and other type electrons to the result is shown. In this and the succeeding interactions oxygen is used as an example. Although the order of the splitting is as observed, the observed asymmetry is not obtained, for the sum of all three effects is a symmetric splitting of the three levels. An explanation of this lack of asymmetry is offered which appeals to the neglect of the exchange portion of the potential in the spin-orbit calculation. (auth)

7907 SC-4390(RR)

Oklahoma State Univ., Stillwater. School of Electrical Engineering.

INVESTIGATION OF DYNAMIC CHARACTERISTICS OF RELAYS. Interim Report covering period September 1 to October 31, [1959]. Jan. 1960. 111p. For Sandia Corp. OTS.

Two groups of relays of the same general type (crystal can) but of different designs and production techniques were investigated to determine if an evaluation of these designs and production methods was feasible by use of transient characteristics. It was found that the designs were quite different; the control of adjustments was the most noticeable difference. One group of relays had good adjustment control while the other had a much less quality of adjustment. A group of relays of the same type was evaluated with respect to a standard. It is assumed that the magnetic circuit of each relay is constant except for the air gap and residual gap. It was found that in each case the air gap had decreased, spring tension increased, and in all but one case, the residual decreased. A type of relay was investigated in which it appeared that the armature started moving at different values of transient coil current, depending on the supply voltage. To investigate the validity of this phenomenon, a relay was chosen in which the armature motion could be recorded. It was found that the energy input increased as the voltage decreased. Also the increase in this energy was due to the energy lost in heating the coil. Results of variable heel gap studies are also included along with a discussion of coil current rate change. (J.R.D.)

7908 SCTM-309-59(14)

Sandia Corp., Albuquerque, N. Mex.

ELEMENTARY THEORY OF AN RF PROBE IN AN IONIZED MEDIUM. Charles W. Harrison, Jr. and David H. Denton, Jr. Oct. 1, 1959. 9p. OTS.

An approximate formula for the impedance of a base-driven missile probe antenna in an infinite dissipative medium for which $\beta h = (2\pi/\lambda)\, h \leq 0.5$ is derived. Here λ is the wavelength and h is the length of the r-f probe. It is shown that when $\Omega = 10 \approx 2\ln(2h/a)$, where a is the radius of the radiator, and the frequency is 6 mc/sec, the reactance of the probe changes as much as 50% as the carrying vehicle proceeds from an environment containing no free charge into an ionized region containing 1.5×10^{11} electrons per cubic meter. Such an electron density occurs at a height of approximately 100 km. From the theoretical point of view, the r-f probe technique of measuring electron densities in the ionosphere is highly successful. (auth)

7909 USNRDL-TR-367

Naval Radiological Defense Lab., San Francisco.

ON PREDICTING THE IGNITION SUSCEPTIBILITY OF TYPICAL KINDLING FUELS TO IGNITION BY THE THERMAL RADIATION FROM NUCLEAR DETONATIONS. S. Martin. Apr. 21, 1959. 31p. (AFSWP-1135).

Ignition threshold energies and ranges of some typical kindling fuels for both kiloton and megaton nuclear weapon air bursts are calculated from previously derived ignition behavior patterns to illustrate the method. The examples demonstrate how the ignition susceptibility of a material can be predicted from the generalized ignition behavior curve with only a knowledge of the optical absorptivity of the material and the readily measurable quantities of thickness and weight per unit area. A means of correcting for the effect of the relative humidity of the exposure environment is also given. No direct experimental verification of the prediction curves has been attempted as yet. (auth)

7910 WADC-TN-59-255

Syracuse Univ., N. Y. Research Inst.

THE ENERGY DISTRIBUTION OF ELECTRONS FROM IONIZING COLLISIONS OF HEAVY PARTICLES. Period [covered]: June 1, 1958 to July 15, 1959. H. W. Berry. July 15, 1959. 32p. Contract AF33(616)-5741.

The energy distribution of electrons produced in inelastic collisions of ions or atoms with atoms has been measured for the cases of H_1 in H_2, H_2 in H_2, and H_2 in Ar. The energy of the incident particles ranged from 500 to 2,000 ev. The electrons released at 90° with the incident ion beam are analyzed in an electrostatic energy analyzer which consists of 90° segments of coaxial cylinders. The results show a monotonic decrease in yield from zero up to 25 or 30 ev where the signal becomes masked by background noise. The yield decreases almost linearly on a semilogarithmic plot vs. the electron energy to about 10 ev and somewhat slower thereafter. While the total yield is about proportional to the beam energy, the spectrum seems to be almost independent of this. The results for H_1 in H_2 are compared with a theoretical computation by Bates and Griffing. Experimental problems and proposed modifications are discussed. (auth)

7911 WADC-TR-58-651

Chicago. Univ.

A SUMMARY REPORT OF SOME INVESTIGATIONS RELATED TO NEUTRON SPECTROMETRY. Robert J. Moon, Gaetano Riccobono, and A. E. Shaw. Nov. 1958. 101p. Contract AF33(616)-5399. (AD-207160).

An investigation was made of the feasibility of various possible methods of measuring the energy spectra for uncollimated neutrons in the energy range 1 to 10 Mev. An energy resolution of 300 kev was assumed. Electrodynamic spectrometers were considered, and various types of fluo-

rescent crystal spectrometers were studied theoretically with regard to efficiency, resolution, accuracy, and minimum size of crystal. Investigations were carried out concerning the preparation of various crystalline scintillators for use in a neutron spectrometer. It was shown that the use of standard techniques for the preparation of fluorescent lithium tungstate by means of the introduction of an excess of lithium oxide produced a compound $Li_6W_2O_9$ along with Li_2WO_4. Properties of mixtures of the two tungstates at high temperatures are given along with some physical properties of single crystals of Li_2WO_4. (W.D.M.)

7912 WADC-TR-59-78(Pt.2)
Kungliga Tekniska Högskolan, Stockholm.
MEASURING ACCURACY IN CREEP TESTS. PART II. INFLUENCE OF THERMAL STRESSES. Period covered: June 1958 to December 1958. Arne Mellgren. Dec. 1, 1958. 58p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: FATIGUE AND CREEP OF MATERIALS. Contract AF61(052)-05. OTS.

The thermal stresses induced in cylinders and plates by non-uniform surface temperatures are calculated. The relations of thermal stresses to creep are then determined for cylindrical and sheet creep specimens. These relations are expressed mathematically for sinusoidal and square wave surface temperature gradients. Numerical examples are presented and discussed. (auth)

7913 WAPD-T-706
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ON A NUMERICAL APPROXIMATION TO THE SOLUTION OF THE ONE-DIMENSIONAL, ONE-VELOCITY TRANSPORT EQUATION WITH ISOTROPIC SCATTERING (thesis). L. A. Hageman. Jan. 1959. 54p. OTS.

Submitted to the Univ. of Pittsburgh.

A numerical approximation to the solution of the one-dimensional, one-velocity neutron transport equation using the method of discrete ordinates is considered. It has been shown that the discrete case is convergent for a modified Gauss-Seidel iteration procedure. A mathematical discussion is presented for the properties of the coefficient matrix formed by the difference equations. The various iterative procedures which may be used to solve the discrete case are discussed. (W.D.M.)

7914 WCAP-1368(and Add.1)
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
SAFETY REPORT FOR THE CAROLINAS VIRGINIA TUBE REACTOR CRITICAL EXPERIMENTS. R. J. French, D. F. Hanlen, F. Kelly, and P. W. Davison. Dec. 21, 1959. 133p. OTS.

Application is made to the AEC for a Construction Permit and a Class 104 Utilization Facility License for the performance of the Carolinas-Virginia Tube Reactor Critical Experiments at the Westinghouse Reactor Evaluation Center. Administrative rules and operating restrictions which were compiled on the basis of past experience and future requirements are set forth. The site, the WREC facilities and administration, the control systems, operations, the credible hazards and accidents, and the methods used in the hazards analysis are described. (W.D.M.)

7915 ZPh-014
Convair, San Diego, Calif.
PENETRATION OF CHARGED PARTICLES INTO AURORAL ZONES. R. M. Rhodes. Apr. 1959. 21p.

A mathematical analysis is performed on the trajectories of charged particles injected along a magnetic line of force of the earth and terminating in the earth's auroral zone. The particles are studied both as they approach the earth in vacuum and as they spiral down through the atmosphere. Numerical solutions are obtained for the trajectories and intensities as a function of altitude in atmosphere for a beam of 10-Mev electrons and 35-Mev protons. For numerical calculations, the particles are assumed to spiral along a line of force which cuts the earth at 67 degrees latitude. (auth)

7916 AWRE-Trans-U-56
SEPARATION OF GASES BY SORPTION PROCESSES. [PART] II. H. Wirth. Translated by J. R. T. Lloyd from Monatsh. Chem. 84, 741-50(1953). 12p.

The separation of systems N_2–O and C_2H_6–C_2H_4–C_2H_2–CO_2 on activated carbon and silica gel is discussed. Means of increasing the sharpness of the separation and the analytical application of the method are mentioned. A vacuum apparatus for working with gases is also described. (W.L.H.)

7917 CEA-tr-A-634
CONTRÔLE DES PILES ATOMIQUES. (Control of Atomic Reactors). H. Sequenz. Translated into French from Elektrotech. u. Maschinenbau 74, 237-43(1959). 23p.

A mathematical treatment of the problem of reactor control is presented. Consideration is given first to neutron density, power regulation, effects of slow neutrons, and effects of temperature. Then reactor control by feedback systems and by raising a differential quotient is discussed. An example of control by water vapor is given. (T.R.H.)

7918 CEA-tr-R-739
EXPERIENCES AVEC LES COUCHES A 600μ EN EMULSION NIKΦI "P". (Experiments with 600μ NIKFI "P" Emulsion Layers). V. A. Belyakov (Beliakov), L. N. Ivanova, L. G. Kozlova, and K. D. Tolstov. Translated intc French by B. de Trezvinsky from Zhur. Nauch. i Priklad. Fot. Kinematografii 2, 325-9(1957). 11p.

Plates of NIKFI-P emulsion 600 μ thick prepared and treated without previous clarifying on glass have an almost homogeneous grain density for relativistic particle tracks. For previous clarifying on glass the lessening of sensitivity within the layer (as compared to the surface) was 2 ± 2% and 6 ± 2% near the glass. The use of a high-frequency field for reheating the emulsion is reasonable for improving the correlation between track density and clouding. (tr-auth)

7919 CEA-tr-R-755
HYPERSENSIBILISATION DES EMULSIONS PHOTOGRAPHIQUES NUCLÉAIRES PAR TRIETHANOLAMINE. (Hypersensitization of Nuclear Photographic Emulsions by Triethanolamine). K. S. Bogomolov, I. A. Ruditskaya (Rouditskaia), A. A. Sirotinskaya (Sirotinskaia). Translated into French by B. De Trezvinsky from Zhur. Nauch. i Priklad. Fot. i Kinematografii 3, 52-3(1958). 5p.

Hypersensitization of P-type emulsions (grain size 30 to 35/100μ) to a sensitivity of 90 to 100/100μ was obtained by triethanolamine. A possible mechanism is discussed. (T.R.H.)

7920 CEA-tr-R-756
INTERPRETATION DES EXPERIENCES SUR L'AUGMENTATION PAR LA TRIETHANOLAMINE DE LA SENSIBILITE DES EMULSIONS PHOTOGRAPHIQUES NUCLÉAIRES. (Interpretation of Experiments on the Increase of the Sensitivity of Nuclear Photographic Emulsions by the Use of Triethanalamine). A. P. Zhdanov, A. L. Kartuzhanskii (Kartouzhanskii), and L. I. Shur (Shour). Translated into French by B. de Trezvinsky from Zhur. Nauch. i Priklad. Fot. i Kinematografii 3, 139-40(1958). 5p.

The increase of track density in emulsions treated with triethanolamine signifies a shortening of the minimum

range of the particle. This shortening is equivalent to the diminution of the number of secondary electrons formed in the crystal and, accordingly, of the number of AG atoms necessary to form a development center. This is compared with other interpretations. (T.R.H.)

7921 NP-tr-337

THE USE OF VACUUM IN METALLURGY. A. M. Samarin, ed. Translated from "Primenenie Vakuuma v Metallurgii," Academy of Sciences, Moscow, 1958. 245p.

Twenty-three papers are presented on the uses of vacuum in metallurgy. The general topics covered by these papers are the melting of steel and alloys in vacuum furnaces, vacuum treatment of liquid steel and ferroalloys in the ladle and ingot molds, and production of pure metals and alloys in a vacuum. (W.L.H.)

7922 NP-tr-339

THE ELECTRICAL PROPERTIES OF SEMICONDUCTORS. S. S. Shalyt. Translated from "Elektricheskiye Svoystva Poluprovodnikov" Vol. 1, Leningrad, 1957. 162p.

A general treatment of conductivity in solids is presented. The sign of the current-carrier charge, intrinsic and impurity conductivities, and temperature-dependence of semiconductor conductivity are discussed. The effect of electromagnetic radiation, electric fields, corpuscular radiation, and deformation on the conductivity of semiconductors was studied. The conductivity of semiconductors was studied. The conductivity of liquid, amorphous, and polycrystalline bodies was investigated. (W.L.H.)

7923

SEARCH FOR A FUNDAMENTAL LENGTH IN MICROSCOPIC PHYSICS. William A. McKinley (Rensselaer Polytechnic Inst., Troy, N. Y.). Am. J. Phys. 28, 129-34 (1960) Feb.

A review is presented of some of the attempts to introduce into microscopic physics a constant of fundamental length. These theories aim to restrict the notion of localizability in the domain 10^{-13} cm or smaller in an effort to remove the well-known divergences which arise in modern field theory. (auth)

7924

ASYMPTOTIC SOLUTION OF EIGENVALUE PROBLEMS. Joseph B. Keller (New York Univ.) and S. I. Rubinow (Stevens Inst. of Tech., Hoboken, N. J.). Ann. Phys. (N. Y.) 9, 24-75(1960) Jan.

A method is presented for the construction of asymptotic formulas for the large eigenvalues and the corresponding eigenfunctions of boundary value problems for partial differential equations. It is an adaptation to bounded domains of the method previously devised to deduce the corrected Bohr-Sommerfeld quantum conditions. When applied to the reduced wave equation in various domains for which the exact solutions are known, it yields precisely the asymptotic forms of those solutions. It was applied to an arbitrary convex plane domain for which the exact solutions are not known. Two types of solutions were found, called the "whispering gallery" and "bouncing ball" modes. Applications were made to the Schroedinger equation. (auth)

7925

THE LAGRANGIAN AND THE ENERGY-MOMENTUM TENSORS IN THE PERTURBATION THEORY OF CLASSICAL ELECTRODYNAMICS. E. L. Chu (Stanford Univ., Calif.). Ann. Phys. (N. Y.) 9, 76-92(1960) Jan.

The theory of infinitesimal transformations is incorporated in the variational principle for the solution of perturbation problems in classical electrodynamics. Every variable quantity is transformed to the unperturbed coordinate system and expanded into a power series of a small perturbation parameter. The Lagrangian of any given order of magnitude in the unperturbed coordinate system characterizes a closed physical system. This is proved by showing that the total energy-momentum tensors of the first and second orders are symmetric. The proof for the higher orders is obtained by deduction. Sturrock's asymmetric tensor is recognized as being the result of using an incomplete Lagrangian. Small-amplitude solutions can also be obtained by first applying variation to the total Lagrangian function and then transforming and expanding the results in different orders of magnitude. This method, as exemplified by the proof of the symmetry of the second-order energy-momentum tensor, is in many cases more convenient. (auth)

7926

IN-OUT FORMALISM FOR NONRELATIVISTIC QUANTUM MECHANICS. Peter J. Redmond and Jack L. Uretsky (Univ. of California, Berkeley). Ann. Phys. (N.Y.) 9, 106-24(1960) Jan.

Nonrelativistic quantum mechanics with two-body interactions are discussed using an in-out operator formalism. The second quantized form of nonrelativistic quantum mechanics is outlined. The necessary conditions are determined to ensure that the field operators in the relativistic theory possess asymptotic forms. Appropriate definitions of the in and out operators are given. It is pointed out that the limiting processes involved in defining the asymptotic operators cannot be uniformly convergent because of the invariance of the theory under time translation which introduces caution in the order of taking limits. Methods based on a suggestion by Zimmerman for finding the commutation relations of the in and out operators are found. The definition and evaluation of the S matrix are given. The properties of nonrelativistic wave packets are discussed. (C.J.G.)

7927

PARALLELISM EXISTING BETWEEN IONIZATION AND SCINTILLATION IN CRYSTALS OF QUININE AND QUINIDINE SALTS BY HYDRATION AND DEHYDRATION. Draguitza M. Kiritch and Dragolioub K. Yovanovitch. Compt. rend. 250, 103-5(1960) Jan. 4. (In French)

A photomultiplier setup was used to study scintillations in crystals of quinine sulfate, quinidine tartrate, and quinine phenylglycine. The scintillation versus time curves obtained showed that ionization and scintillations increase if one pulverizes the crystals. (T.R.H.)

7928

MEASUREMENT OF THE SPIN-LATTICE RELAXATION TIME OF Cu^{63} AS A FUNCTION OF TEMPERATURE. Bernard Carcenac de Torné (Institut Fourier, Grenoble, France). Compt. rend. 250, 512-14(1960) Jan. 18. (In French)

A spin-echo apparatus was constructed to measure spin-lattice relaxation times of metals. The precision of such measurements as a function of the precautions taken is discussed, and preliminary results are given from the study of Cu^{63} versus temperature. (tr-auth)

7929

EFFECTS OF FREQUENCY ON THE SEMI-CONDUCTIVITY OF MANGANESE DIOXIDE WITH THORIUM ADDITIONS. Jean-Pierre Chevillot and Jean Brenet. Compt. rend. 250, 515-17(1960) Jan. 18. (In French)

A study was made of the effects of addition of Th^{4+} to the lattice of MnO_2 on the variation of resistivity with applied frequency. The resistivity isotherms thus obtained were compared with those of MnO_2 with Li^+ additions. In these different cases the rates of variation of the activation energy with frequency are very variable. (tr-auth)

7930

THE STUDY OF THE PHOTODIELECTRIC LUMINESCENCE PROPERTIES OF ZnS AND CdS. Ivan Soudek (Forschungsinstitut für Vakuumelektrotechnik, Prague). Czechoslov. J. Phys. 9, 590-6(1959). (In German)

The spectral dependence of the photodielectric luminescence properties of various compositions of ZnS and CdS shows that a Cu impurity develops a phase with greater polarizability, which results in a change in the actual component of the dielectric constant. The copper concentration can be limited, in that it is not important in the luminescence emissions. The infrared loss maxima correspond to levels established by other authors and methods. The maximum excitation spectra of the attendant lines of the absorption margin range are connected with the maximum variation of the actual components of the dielectric constant. (B.O.G.)

7931

OBSERVATIONS OF THE ELECTROLUMINESCENCE THEORY IN ZnS CRYSTALS. Karel Kuchař (Karlsuniversität, Prague). Czechoslov. J. Phys. 9, 679-84 (1959). (In German)

According to Zalm, ZnS crystals are covered with thin semiconductor layers infiltrated from the basic electron tunnel effects in the crystal. It is assumed that electroluminescence occurred at the recombination of electrons with the ionized central activator. Electroluminescence is found in the crystal at the beginning of every cycle of the activator system. The conclusion of this supposition was compared with experimental data. (B.O.G.)

7932

ABSOLUTE CALIBRATION OF A Ra-Be NEUTRON SOURCE. G. P. Felcher, E. Germagnoli, and M. Musci (Centro Informazioni Studi Esperienze, Milan and Istituto di Fisica del Politecnico, Milan). Energia nucleare (Milan) 7, 31-8(1960) Jan. (In English)

The strength of a Ra-Be neutron source (504.81 mg Ra + 2.5 g Be) has been determined by absolute measurement of the thermal neutron flux at one position within a water tank and subsequently normalizing the relative values of the neutron flux at any other position. The source strength resulted to be $(5.87 \pm 0.18)\ 10^6$ neutrons sec^{-1} (auth)

7933

ENERGY LEVELS IN DISTORTED COULOMB FIELD. Ya. B. Zel'dovich (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Fiz. Tverdogo Tela 1, 1637-41(1959) Nov. (In Russian)

It is shown that with Coulomb potential present everywhere except the small area near the origin of the coördinate, the spectrum, as a rule, differs very little from the standard spectra of Bohr hydrogen. A certain distortion of the spectrum is possible only in the presence of a disturbing potential with resonance scattering of low-energy particles. The Coulomb energy level variations are shown to be proportional to the particle densities at the coördinate origin in undisturbed derivations. (R.V.J.)

7934

LUMINESCENCE OF IMPURITY CENTERS. [PART] I. A. M. Ratner and G. E. Zilberman (Khar'kov Inst. of Chemical Reagents). Fiz. Tverdogo Tela 1, 1697-1706 (1959) Nov. (In Russian)

The absorption and light intensity factors as functions of spectral dependence were estimated for phosphors with impurity centers. The ion mobility is taken as classical. Variations of ion equilibrium and lattice constants were evaluated. The relationships between the variations of elastic constants, absorption spectra, and luminescence from mirror symmetry were found as well as the shape of the Gaussian curve. It is shown that the variation of elastic constants can be disregarded only when "mirror symmetry" is fulfilled. The results can be applied to crystalline, amorphous, or liquid phosphors (independent of local oscillations). (tr-auth)

7935

LUMINESCENCE OF IMPURITY CENTERS. [PART] II. A. M. Ratner (Khar'kov Inst. of Chemical Reagents). Fiz. Tverdogo Tela 1, 1707-16(1959) Nov. (In Russian)

Probabilities of thermal transitions between discrete levels specified by the admixture center are estimated. The mobilities of ions are analyzed classically. The shift of ion equilibrium and changes of elastic constants in a lattice during electron transition are considered. The relationship between the shape of absorption and luminescence spectra and thermal transition probabilities was established. It is found that elastic constants considerably affect the calculated results. Qualitative comparisons of theory and experiment indicate the mechanism of energy transition from the lattice to admixture atoms during strong irradiation induced crystal excitation. (tr-auth)

7936

MAGNETIC RESONANCE: A METHOD OF DETERMINING NUCLEAR MOMENTS. Georges-J. Béné (Université, Geneva). Inds. atomiques 3, No. 11-12, 37-51(1959). (In French)

A discussion is given of nuclear moments, their interaction with exterior fields, and magnetic resonance. The magnetic resonance method of determining nuclear moments is described. (T.R.H.)

7937

POSSIBLE EXPLANATION OF THE CURRENT DENSITY-DEPENDENT RESISTIVITY OF EXPLODING WIRES. T. J. Tucker (Sandia Corp., Albuquerque, N. Mex.). J. Appl. Phys. 30, 1841-2(1959) Nov.

As a result of current density-dependent resistivity in exploding wires, there is a corresponding variation of the total energy input to the wire. The behavior of gold wire in the resistance regions 4×10^7 and 1.2×10^8 amp/cm^2 was studied with the aid of Kerr-cell photographs. Breakdown modes in the formation of shunting air arcs and in the vaporized wire material itself were observed. (C.J.G.)

7938

BULK DENSITIES OF SEPARATED COPPER ISOTOPES. D. D. Snyder (General Motors Corp., Warren, Mich.). J. Appl. Phys. 31, 440-1(1960) Feb.

The bulk densities of specimens rich in either Cu^{63} or Cu^{65} with the other as an impurity and natural copper (Cu^{63}, 69.1%; Cu^{65}, 30.9%) were measured. These values were compared to values calculated from crystallographic and isotopic data. In the calculations from experimental data, allowances were made for impurities in each sample. (B.O.G.)

7939

COMPRESSIBILITY OF HELIUM AT −10° TO 130°F AND

PRESSURES TO 4000 P.S.I.A. Lowell Stroud, John E. Miller, and L. Warren Brandt (Bureau of Mines, Amarillo, Tex.). J. Chem. Eng. Data 5, 51-2(1960) Jan.

The Burnett method was used to investigate the compressibility of helium at −10 to 130°F and pressures to 4000 psia. The experimental values are compared with the calculated values for the compressibility factor. The greatest deviation for any individual pressure was 0.22% at 130°F and 3990 psia. (B.O.G.)

7940

THEORY OF FLAME PROPAGATION IN SOLID NITROGEN AT LOW TEMPERATURES. S. G. Reed (Office of Naval Research, Washington, D. C.) and C. M. Herzfeld (National Bureau of Standards, Washington, D. C.). J. Chem. Phys. 32, 1-2(1960) Jan.

A theory for a flame in a solid whose speed is controlled by diffusion of radicals and heat is applied to slowly propagating flashes observed in solid nitrogen deposited at 4°K from a microwave discharge. Reasonable agreement is obtained with observed speeds. (auth)

7941

VIBRATION-ROTATION BANDS OF AMMONIA. IV. THE STRETCHING FUNDAMENTALS AND ASSOCIATED BANDS NEAR 3 μ. W. S. Benedict (Johns Hopkins Univ., Baltimore) and Earle K. Plyler and E. D. Tidwell (National Bureau of Standards, Washington, D. C.). J. Chem. Phys. 32, 32-44(1960) Jan.

High-resolution spectra of NH_3, yielding 1800 lines between 3060 to 3580 cm^{-1}, are presented. Analysis of the ν_3 fundamental is complete through $J' = 9$ and presents no unexpected features. Resolution of the K substructure in the ν_1 fundamental shows that several perturbations are present. The most important of these, involving a Fermi resonance with the parallel component of $2\nu_4$, and a Coriolis resonance with its perpendicular component, are clarified. Lines in both components of $2\nu_4$ are identified through $J' = 6$, and a strong Coriolis interaction between the $l = 0$ and $l = 2$ states is observed and discussed. (auth)

7942

DETERMINATION OF SURFACES AND SPECIFIC INTERFACES BY CENTRAL SCATTERING OF X RADIATION. II. EXPERIMENTAL RESEARCH. C. Alexanian, S. Durif, and J. L. Soule (Centre d'Etudes et Recherches des Charbonnages de France, Verneuil-en-Halatte). J. phys. radium 20, Suppl. No. 12, 139A-52A(1959) Dec. (In French)

An account is given of the experimental studies carried out to find, in different cases, the best conditions of applying of the theoretical results, in particular, to the determination of specific surfaces. After a survey of the experimental difficulties to be overcome and of the main sources of errors in the absolute measurement of the scattering intensity, it is shown that the conditions of application depend upon the magnitude of the internal structure. For extreme structures, only one method is applicable: an attenuator must be used; for intermediate structures, the use of sufficiently thick samples ensures that the scattered and directly transmitted intensities have the same range of magnitude. Examples are given of the different ranges of structure and a comparison is made of the methods used in the case of intermediate structures. (auth)

7943

ELECTROLUMINESCENCE IN ZINC SULFIDE SINGLE CRYSTALS. Shin-ichiro Narita (Shizuoka Univ., Japan). J. Phys. Soc. Japan 15, 128-36(1960) Jan.

By using the vapor-phase synthesis method, zinc sulfide single crystals were grown from pure zinc and a hydrogen sulfide bomb and they were doped with two impurities, copper and chlorine. The brightness waves of electroluminescence in these crystals were studied by applying rectangular pulse voltage. Since the E. L. of "in phase" was dominant in the crystals lacking chlorine and having appreciable voltage-dependency, it was concluded that it occurred as a result of the injection of electrons from the cathode. In order to classify the mechanism of E. L. of "out of phase," infrared quenching of E. L. was used. E. L. in ZnS:Cl, Cu was a typical case sensitive to the quenching, and E. L. in artificial junction (ZnS:Cl−ZnS:Cu) was the typical case insensitive to the quenching. It was supposed that the difference between these two cases resulted from the difference in the mechanism supplying the primary electrons of E. L. (auth)

7944

THERMOLUMINESCENCE OF ZINC SULFIDE PHOSPHORS. Kikusaburo Osada (Nagoya Univ., Japan). J. Phys. Soc. Japan 15, 145-9(1960) Jan.

The glow curves of the thermoluminescence of some zinc sulfide phosphors are measured for two different exponential heating rates by means of an oscilloscope, and the values of the depth and frequency factor of their traps are obtained by the Booth method. The value of the frequency factor is not constant for all traps, but becomes larger as the depth increases. Equations are developed which permit the analysis of the glow curves for the exponential heating rate. (auth)

7945

AN ANALYSIS OF THE FLUORESCENCE SPECTRUM OF EUROPIUM ETHYL SULPHATE. B. R. Judd (Clarendon Lab., Oxford). Mol. Phys. 2, 407-14(1959) Oct.

A theoretical analysis is made of the splittings induced in the levels $^7F_1$, $^7F_2$, $^7F_3$, $^7F_4$, $^7F_5$, $^7F_6$ of the ion Eu^{3+} by the electric field of the ethyl sulfate lattice. Four parameters are used to fit the data, and it is found that very good agreement can be established between experiment and theory in the great majority of cases. The parameters are compared to the corresponding ones for other rare earth ethyl sulfates. A reason is given for the absence of a magnetic dipole character in the transition $^5D_1 \rightarrow {}^7F_1$. (auth)

7946

DIFFERENCES IN FLUORESCENCE DECAY OF ZnS(Ag) FOR PARTICLES OF DIFFERENT IONIZATION THICKNESSES. J. Warncke and H. Neuert (Physikalisches Staatsinstitut, Hamburg). Naturwissenschaften 47, 11 (1960) Jan. (In German)

The pulse discrimination effect in ZnS(Ag) was studied using Po α particles, (D,D) protons, and secondary electrons. The pulses thus obtained produced voltage pulses in relation to the fluorescence decay process from which current pulses were obtained by graphic differentiation according to work-time constant considerations. These current pulses were then analyzed from exponential decay components. By selection of the proper time constants a direct particle discrimination is possible. (T.R.H.)

7947

TOPICS IN THE THEORY OF DISPERSION RELATIONS. G. R. Allcock (Univ. of Liverpool). Nuclear Phys. 14, 177-98(1959) Dec. (2).

The mathematics and physics of the theory of dispersion relations are discussed, with particular reference to the quantized field description of the scattering by a fixed center. Various known analytic continuations of physical data are examined for mathematical stability, and the dispersion relation at fixed momentum transfer is proved by

a method which is susceptible to the operations of numerical analysis. It is suggested that such stability is a necessary feature of a satisfactory proof. The scattering problem is formulated entirely in terms of the fields at large but finite distances from the scatterer, and this leads to a direct and perspicuous treatment of the "unphysical" region. The effect of finite violations of microscopic causality is expressed quantitatively through a new dispersion relation which, while still dealing only with accessible scattering data, embodies within itself a fundamental length. (auth)

7948

AN ASYMPTOTIC CAUSALITY REQUIREMENT FOR SYSTEMS WITH CONSTRAINED INPUTS. J. Sucher (Univ. of Maryland, College Park). Nuclear Phys. 14, 363-9(1959) Dec. (2).

The usual formulation of causality for simple linear systems: "no output before input," may fail to imply that the system kernel $K(\tau)$ is a causal function of the time delay τ, because the class of physically admissible input functions may not contain a complete set of causal signals. An attempt is made to formulate a causality requirement, asymptotic in nature, which overcomes this difficulty. It is found, rather generally, that systems which satisfy this requirement cannot have a finitely acausal kernel. If it could be shown that the kernel cannot be infinitely acausal, the validity of the usual dispersion relations for such systems would be ensured. (auth)

7949

THE HIGH-VOLTAGE PHOTOEFFECT IN ZnS SINGLE CRYSTALS. J. Tauc (Inst. of Technical Physics, Czechoslovak Academy of Sciences, Prague). Phys. and Chem. Solids 11, 345-6(1959) Oct.

A new photovoltaic effect in ZnS single crystals was observed which differs from the usual types in two principal ways: the photovoltage is much higher than the voltage corresponding to the energy gap and changes its sign with the wave length of the light. It is stressed that this effect is caused by stacking faults within the crystal. One explanation for this effect is that inside the crystal an internal field is present which is additive along the crystal or that there are a series of potential barriers of alternating sign inside the crystal. A model is proposed in which the effect exists only when stacking faults are present and the gaps of the cubic and hexagonal structures differ by 0.1 ev. Additional assumptions are made in order to facilitate further investigations of high-voltage effects. (B.O.G.)

7950

MICROWAVE FARADAY ROTATION IN ANTIFERROMAGNETIC MnF_2. A. M. Portis and Dale Teaney (Univ. of California, Berkeley). Phys. Rev. 116, 838-45(1959) Nov. 15.

Microwave Faraday rotation was observed in MnF_2 from 30 to 300°K. The antiferromagnetic resonance frequency is computed from the rotation measurements below the Néel point. The results are in good agreement with direct observation of the antiferromagnetic resonance and molecular field theory extrapolations except close to the transition where evidence for magnetic clustering is found. The Kramers-Kronig relations are applied to antiferromagnetic media and it is shown that the Faraday rotation depends both on the shift of the resonance with field and on very small field-induced intensity changes which are present. A study of Faraday ellipticity establishes the need for using terms in the equation of motion which relax the magnetization toward the instantaneous field direction. (auth)

7951

EFFECT OF SPIN-ORBIT COUPLING ON THE ENERGY LEVELS IN THE 6d BAND FOR ACTINIDE METALS. Guy W. Lehman (Atomics International, Div., North American Aviation, Inc., Canoga Park, Calif.). Phys. Rev. 116, 846-51(1959) Nov. 15.

The importance of spin-orbit coupling in modifying the energy levels in the 6d band for the actinide metals is discussed. The energy matrix, H_0, used in this paper, neglecting spin-orbit effects, is derived from Kohn's variational principle by expanding the wave function in terms of the five atomic d orbitals having cubic symmetry. A single disposable parameter, E_d, occurs in this model such that $2E_d$ is the width of the d band. The spin-orbit energy matrix, H_{so}, contains the spin-orbit splitting parameter, E_{so}, which is equal to the $d_{\frac{5}{2}} - d_{\frac{3}{2}}$ level separation. The complete 10×10 energy matrix was diagonalized analytically along a fourfold symmetry axis and numerically at 150 points in the Brillouin zone for the case $E_{so}/E_d = 0.2$ appropriate to face-centered cubic thorium with $E_{so} = 0.4$ ev and $E_d = 2$ ev. Plots of the energy variation along the two, three, and fourfold axes in the Brillouin zone are presented. Calculations based upon this model are also presented which show that the usual Pauli spin paramagnetism of the conduction electrons can be modified quite significantly by spin-orbit coupling. (auth)

7952

ANOMALOUS THERMIONIC EMISSION OF SOME BORIDES AND CARBIDES OF RARE EARTH AND TRANSITION ELEMENTS. E. A. Kmetko (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 116, 895-6(1959) Nov. 15.

Thermionic emission constants, A*, up to several thousand times larger than the A_0 (120 amp/cm^2 – °K^2) predicted theoretically for metals were reported for several compounds involving transition metals and rare earths with boron and carbon. It is suggested that such anomalously large emission constants, as well as some anomalously small ones, are due to the relatively large distances between metal atoms as a result of which the energy bands originating from the incomplete atomic f and/or d sublevels are narrow enough for nondegeneracy to occur in the experimental temperature range. (auth)

7953

GENERALIZED ATOMIC MASS LAW. Forrest S. Mozer (California Inst. of Tech., Pasadena and Lockheed Missiles and Space Div., Palo Alto, Calif.). Phys. Rev. 116, 970-5 (1959) Nov. 15.

Least-squares analyses were performed on a set of atomic masses using standard and generalized semiempirical mass laws. Presumably because of errors in the assumed form of the standard mass law, its least-squares coefficients can be determined at best to an accuracy of about 10%, and masses are predicted with an uncertainty of several Mev/c^2. The standard mass law was generalized by addition of shell effect and deformation terms. While the least-squares fitting of the generalized mass law is better than for the standard mass law, it is still not possible to predict atomic masses to an accuracy better than a few Mev/c^2. The nuclear deformations and the well depth of the nuclear interaction obtained from the additional mass-law terms are in reasonable agreement with more accurate determinations by other methods. A similar statement applies to the nuclear radius constant as obtained from the least-squares coefficient of the Coulomb energy term. A study was made of the effects of additional terms proportional to the absolute value of the isotopic spin, exchange and surface corrections to the Coulomb

energy, and the surface correction to the normal isotopic term. (auth)

7954

IONIZATION YIELDS FOR FISSION FRAGMENTS. N. G. Utterback and G. H. Miller (Iowa State Univ. of Science and Tech., Ames). Phys. Rev. 116, 976-80(1959) Nov. 15.

The ratio of fission fragment-to-alpha particle ionization produced in total stopping was measured in the gases helium, argon, and a helium plus 0.25% argon mixture. A parallel-plate gridded electron collection chamber was used. Gas purity and electron loss were checked by making absolute average energy per ion pair measurements for alpha particles. These agreed with the values reported for total ion collection. The difference in ionization defects between helium and argon is consistent with the value predicted by Knipp and Ling on the basis of the greater importance of elastic atomic collisions in argon. Because adding a small amount of argon to helium enables the metastable helium atoms to produce ionization, the difference in the fission fragment-to-alpha particle ionization ratios between helium and the helium plus argon mixture shows that the ionization-to-excitation ratio in helium is lower for fission fragments than for alpha particles. Arguments are given which indicate that very little "defect" is present for fission fragments in the helium plus argon mixture. (auth)

7955

MEASUREMENTS OF ATOMIC VELOCITY DISTRIBUTIONS IN Hg AND HgO BY THE NUCLEAR RESONANT SCATTERING OF GAMMA RAYS. D. C. Champeney and C. A. Miller (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) 74, 680-4(1959) Dec. 1.

Utilizing a technique based on the nuclear resonant scattering of gamma rays, the thermal velocity distributions of the mercury atoms in mercury at 296°K and in mercuric oxide at 77°K were measured. In agreement with theoretical predictions, the distributions are found to be Maxwellian in shape but corresponding to a distribution appropriate to an effective temperature higher than the actual one. (auth)

7956

ISOTOPE SHIFT IN THE CdI INTERCOMBINATION RESONANCE LINE λ 3261Å. F. M. Kelly and E. Tomchuk (Univ. of Manitoba, Winnipeg, Can.). Proc. Phys. Soc. (London) 74, 689-92(1959) Dec. 1.

The isotope shifts in the intercombination resonance line of CdI were measured. The line was excited in an atomic beam by electron bombardment and the high resolution obtained with a Fabry–Perot interferometer. The shifts between even isotopes decreased with increasing neutron number and the odd isotopes were close to the next lighter even isotope showing a pronounced odd–even staggering. The relative shifts are in agreement with those of other Cd lines. (auth)

7957

EFFECTS OF s-d INTERACTION ON TRANSPORT PHENOMENA. Tadao Kasuya (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto) 22, 227-46(1959) Aug.

The effects of the s-d interaction on transport phenomena of ferromagnetic metals and alloys are discussed. Electrical and thermal conductivities and thermoelectric effect are calculated with the simple molecular field approximation, and an anomalous thermoelectric effect is expected in these substances. In sufficiently low temperatures, the disordering of the spin system is described by the collective mode of spin wave. The calculations of transport coefficient by using the spin wave approximation are carried out. (auth)

7958

THE METHOD OF SOLVING ELECTROMAGNETIC PROBLEM FROM THE KNOWN SOLUTIONS OF THE CORRESPONDING STATIC PROBLEM. Lin Wei-Guan (Chengtu Inst. of Radio Engineering, China). Wu Li Hsüeh Pao 15, 450-64(1959) Sept. (In Chinese)

If an electromagnetic field is represented by a pure electric wave (E-wave or TM wave, transverse magnetic field) or a pure magnetic wave (H-wave or TE wave, transverse electric field), then as a boundary value problem with the operating frequency tending to zero, the electromagnetic field will be reduced to an electrostatic or a magnetostatic field, respectively. The solution of such an electromagnetic problem was obtained from that of the corresponding static problem, because there exists a one-to-one correspondence between the terms of the series solution of the electromagnetic problem and those of the series solution of the static problem. Two possibilities of the existence of pure electric waves and pure magnetic waves were noted. One exists in coordinate systems and the other in problems where some forms of symmetry exist so that the system of Maxwell's equations can be broken into two independent groups, respectively called electric and magnetic waves. The problem of the excitation of waveguides by a dipole was solved by the proposed method from the known solution of the corresponding static problem. (auth)

7959

A NEW METHOD OF SOLVING THE PROBLEM OF DIFFRACTION BY A NARROW SLIT. Lin Wei-Guan (Chengtu Inst. of Radio Engineering, China). Wu Li Hsüeh Pao 15, 465-8(1959) Sept. (In Chinese)

The problem of diffraction by a narrow slit in an infinitely thin and perfectly conducting plane is solved from the known solution of the corresponding magnetostatic problem. (auth)

7960

A VERSATILE UNIVERSAL DETECTOR FOR ATOMIC BEAMS. H. Friedmann (Universität, Munich). Z. Physik 156, 598-602(1959). (In German)

The atomic beam modulated by a contact breaker was ionized by electron collision in a low-noise ionizer and the ion beam was observed behind a narrow-band amplifier. The detector is especially suitable for the determination of the spatial distribution of atoms in scattering or polarization investigations. The sensitivity is the same as that obtained in the Fricke detector in which the ions were separated in a mass spectrometer. An atomic beam with a particle density of 2×10^5 particles/cm^3 was detected in a residual gas density of 7×10^{10} (2×10^{-6} Torr). (tr-auth)

7961

INVESTIGATIONS ON CATHODE THERMOLUMINESCENCE. [PART] II. H. Gobrecht, H. Nelkowski, and D. Hofmann (Technische Universität, Berlin). Z. Physik 156, 657-66(1959). (In German)

The temperature dependence of the cathode luminescence of various luminescent materials (3 zinc cadmium sulfides of various compositions, calcium silicate, and halophosphate) was investigated between 90 and 450°K. Glow curves were traced according to the cathode beam excitation. Distinct variations between the cooling and heating curves were found only in very weak cathode beam excitation. They are explained as the effect of the electrons stored in bond sites. This effect is not detectable at large excitation intensities, since the glow light increases less than proportionally with the excitation (measured in calcium silicate and zinc cadmium

sulfide SF 305), which was reduced back to a saturation phenomenon in the bond site filling. The cooling and heating curves agree in all five luminescence materials within the measuring accuracy; the light emission is, in strong excitation, a definite function of the temperature characteristic for each phosphor. (tr-auth)

7962

OPTICAL PROPERTIES OF INTERFERENCE FILTERS IN MEASUREMENT WITH FINITE WIDTH SPECTRAL RANGES. G. Koppelmann and K. Krebs (Universität, Berlin). Z. Physik 157, 592-600(1960). (In German)

A special procedure of evaluation permits—from measurements of the transmissibility of interference filters possessing a very narrow band width—the very accurate determination of both the half width and the position of the transmitted spectral range. Using this procedure a method is developed, that permits the elimination of those errors in the determination of the optical properties of the filters which are due to the finite width of the spectral range used for the measurements. Both methods are illustrated by experimental examples. (auth)

7963

MOLECULAR SCATTERING AT THE SOLID SURFACE. F. C. Hurlbut (Univ. of California, Berkeley). p.145-56 of "Recent Research in Molecular Beams." Immanuel Esterman, ed. New York, Academic Press, 1959. 194p.

The physics of molecular scattering interactions at the gas-surface interface was studied through the use of the molecular beam. Polar plots of nitrogen, argon, and air scattering by various forms of steel, aluminum, glass, and teflon are given. The results are examined in terms of a rarefied gas flow to gain insight of fluid friction in such flow. (C.J.G.)

7964

A CALCULATION OF THE ENERGY BANDS OF THE GRAPHITE CRYSTAL BY MEANS OF THE TIGHT-BINDING METHOD. F. J. Corbató (Massachusetts Inst. of Tech., Cambridge). p. 173-8 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

The graphite crystal is approximated by a two-dimensional hexagonal lattice of carbon atoms. One-electron wave functions of appropriate translational symmetry are formed by making Bloch waves from the 1s, 2s, 2px, 2py, and 2pz Hartree-Fock atomic orbitals of carbon. The crystal potential is taken to be a superposition of spherically symmetric atomic potentials formed from the effective nuclear charge function of atomic carbon. From the usual variational principle, the energy bands (energy values as a function of the Bloch wave vector) are given by the solution of an 8 by 8 secular equation formed from the σ states which are symmetric in the plane of the graphite sheet and a 2 by 2 secular equation formed from the π states which are anti-symmetric in the plane of the graphite sheet. The secular equations are solved for 25 representative wave vectors. The resultant one-electron energy bands show σ bands which cross over parts of the π bands, however, there is an energy gap in the σ bands which encloses the Fermi level in the π bands. Therefore there is support for the usual approximation of only considering the π states in calculations of the conduction properties of three-dimensional graphite. (auth)

7965

BAND STRUCTURE AND MAGNETIC PROPERTIES OF GRAPHITE. J. W. McClure (National Carbon Co., Cleveland). p.179-82 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

The de Haas-van Alphen effect in the magnetic susceptibility of graphite was interpreted by applying the susceptibility formula for general bands of Lifshitz and Kosevich to the band model of Slonczewski. The majority of electrons and holes are responsible for the two periods of oscillation of the susceptibility. The analysis yields information concerning the band structure: (1) the total band overlap is 0.032 ev, (2) the energy difference between the two doubly degenerate bands at the corner of the Brillouin zone is about 0.02 ev, (3) γ_0 must be larger than about 1.2 ev, and (4) the relation $\gamma_1 = 0.04\gamma_0^{\frac{1}{2}}$ holds approximately (where both γ's are in eV and correspond to Wallace's notation). The carrier concentrations are found to be about 2.3×10^{-5} e/atom and 1.8×10^{-5} holes/atom, in agreement with the carrier concentrations deduced from galvanomagnetic data. (auth)

7966

CYCLOTRON RESONANCE IN GRAPHITE (EXPERIMENTAL). J. K. Galt, W. A. Yager, and F. R. Merritt (Bell Telephone Labs., Inc., Murray Hill, N. J.). p. 193-6 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

Cyclotron resonance absorption was observed in crystalline flakes of graphite at 77, 4.2, 1.3, and 1.1°K with circularly polarized waves at 24,000 and 72,000 Mc/s. A brief description of the test cavity, method of obtaining circular polarization, and measurement techniques is given. The data show a rather complex structure consisting of a broad variation in power absorption coefficient at both positive and negative magnetic fields (majority carriers) plus several sharper singularities at low fields on each size of zero (minority carriers[1]). Observations at the two frequencies show that the singularities obey the cyclotron resonance equation. It is clear from the frequency dependence of the data that the carriers all have effective masses small compared to that of a free electron. (auth)

7967

MAGNETIC FIELD DEPENDENCE OF THE HALL EFFECT AND MAGNETORESISTANCE OF GRAPHITE SINGLE CRYSTALS. D. E. Soule (National Carbon Research Labs., Cleveland). p.203-10 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

The Hall effect and magnetoresistance in purified natural graphite single crystals were measured at 298, 77, and 4.2°K from 25 to 25,000 gauss with the magnetic field oriented parallel to the hexagonal axis. Unusual effects were observed in the very low field region (H ~25–300 gauss) showing the influence of highly mobile minority current carriers. For higher fields at 4.2°K, oscillations of the de Haas-van Alphen type were found in both R and $\Delta\rho/\rho_0$ with a phase difference of π. The oscillatory component consisted of two periods, 2.11×10^{-5} and 1.58×10^{-5} gauss, that are correlated with those found in the susceptibility. These periods correspond to the majority electrons and holes, respectively, as determined by a direct comparison for the same crystal of carrier densities calculated from the oscillatory and non-oscillatory behaviors. From an analysis of the field dependence of these oscillations, effective mass values of $0.030m_0$ and $0.060m_0$ were calculated for the majority electrons and holes, respectively. These are in substantial agreement with those found from the temperature dependence of the de Haas-van Alphen oscillations and from cyclotron resonance. The corresponding Fermi energies are 0.018 ev and 0.012 ev giving a band overlap for graphite of 0.030 ev. (auth)

7968
THE ENERGY EXCHANGE BETWEEN COLD GAS MOLECULES AND A HOT GRAPHITE SURFACE.
L. Meyer and R. Gomer (Univ. of Chicago). p.425-31 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

Hydrocarbons do not decompose on hot graphite surfaces up to 2300°C if the gas pressure is so low that the mean free path of the gas molecules exceeds the dimensions of the vessel. This paradox led to a detailed study of the exchange of energy between a cold gas molecule and the hot surface. It was found that gas molecules reaching the surface are held by physical adsorption until they reach a critical temperature at which they evaporate. This critical temperature depends on the van der Waals' forces between the graphite and the gas molecule, but is essentially independent of the graphite temperature as long as the latter is higher than this critical temperature. Methane, e.g., evaporates at about 500°C with graphite temperatures ranging from 850 to 1500°C and methane temperatures between room temperature and 400°C. The methane does not decompose during its contact with the hot graphite surface as it does not reach a temperature sufficiently high to cause decomposition before it evaporates. To gain quantitative insight into the lack of decomposition of methane, the energy exchange between the hot graphite filament and cold molecules of H_2, He, Ne, and Kr was investigated. (auth)

7969
DISLOCATIONS IN GRAPHITE CRYSTALS. T. Tsuzuku (Chuetsu Factory of the Tokyo Electrode Mfg. Co., Ltd., Toyama-Perfecture, Japan). p.433-50 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

By means of electron microscopy, artificial graphite specimens were investigated, and some aspects of the structure associated to the dislocations revealed: pyramidal layer growth of hexagonal monocrystals, formation of conical crystal habit by spiral mechanism, laminar cleavage of spiraled crystals along the basal plane, occurrence of polygonization, network of hollow dislocations, and stacking faults and polytypism. The mechanism of creation of initial dislocations during the graphitization process is briefly reviewed. Special attention is paid to the contribution of thermal stresses caused by the anisotropic expansion of crystallites. (auth)

7970
LATTICE VIBRATIONS AND LOW TEMPERATURE THERMAL PROPERTIES OF GRAPHITE. J. A. Krumhansl (National Carbon Co., Cleveland). p.511-14 of "Proceedings of the Third Conference on Carbon." New York, Pergamon Press, 1959.

The lattice vibration spectrum of anisotropic solids was studied extensively for graphite. Anisotropy can be shown to serve mostly as a suitable circumstance in which to observe the significant role played by directional interatomic forces. In graphite, bending of bonds in the layer planes is the major factor determining the specific heat. Differences in heat capacities of lampblack and natural graphite are proposed to be due to the imperfection weakening of the normal contributions to shear elastic constants between layer planes in lampblack material. (auth)

7971
NEW TYPE OF RADIOACTIVE RADIATION SOURCE WHOSE CARRIER IS BUILT AS A PERMANENT MAGNET. (to Deutsche Edelstahlwerke AG.). German Patent DAS 1,039,656. Sept. 25, 1958. Atompraxis 5, 501(1959). (In German)

A radioactive radiation source in which the carrier absorbing the radioactive material or the material itself forms a permanent magnet or permanent magnet system is described. In this way the radiation source could be fastened temporarily in the desired place on ferromagnetic parts, stands, or plates without using any mechanical clamp devices. Also, not too heavy ferromagnetic objects, which are to be irradiated or investigated, could be brought to sit here to the source itself. According to the claims the radioactive material could be embedded in the permanent magnet during its fabrication. It is also possible to construct the magnet from activated materials. The preparation of the radiation source is described in detail. (J.S.R.)

7972
NEW APPARATUS FOR THE APPLICATION OF RADIOACTIVE IRRADIATORS. (to Nuclear Engineering Ltd.). German Patent DBP 1,046,207. July 9, 1959. Atompraxis 5, 502(1959). (In German)

An apparatus is described for the utilization of the radiations from radioactive materials in which the radiation source, both in its idle position and in its treatment position, is so shielded that no danger exists for men coming in the immediate vicinity. Therefore, several sources of different high intensities could be held in readiness in the apparatus. The screen holder contains at least two radioactive sources which can be brought alternately to the treatment head. The source tracks are disconnected by interlocking mechanisms to separate the source from the treatment head. The interlocking mechanisms are simultaneously put in operation by the operating mechanism of the sources. In this manner it is possible to have ready radiation sources of varying intensities with which a larger number of different kinds of treatment can be carried out. (J.S.R.)

7973
RADIOACTIVE BATTERY. J. H. Birden and K. C. Jordan (to U. S. Atomic Energy Commission). U. S. Patent 2,913,510. Nov. 17, 1959.

A radioactive battery which includes a capsule containing the active material and a thermopile associated therewith is presented. The capsule is both a shield to stop the radiations and thereby make the battery safe to use, and an energy converter. The intense radioactive decay taking place inside is converted to useful heat at the capsule surface. The heat is conducted to the hot thermojunctions of a thermopile. The cold junctions of the thermopile are thermally insulated from the heat source, so that a temperature difference occurs between the hot and cold junctions, causing an electrical current of a constant magnitude to flow.

Cosmic Radiation

7974 AD-216789
Michigan. Univ., Ann Arbor. Willow Run Labs.
PHOTOGRAPHY OF COSMIC RAY TRACKS WITH A CASCADE LUMINESCENT CHAMBER. Report No. 2900-11-T. Lawrence W. Jones and Martin L. Perl. May 1959. 18p.

A cascade luminescent chamber made up of three image tubes coupled with refractive optics was used to photograph tracks of cosmic ray μ mesons in a sodium iodide crystal. The very high time resolution and postevent triggering achieved through these experiments will facilitate experimentation with impure beams from acceleration and with cosmic rays. The apparatus is described with details of measurement on image tube characteristics and the nature of background. The same type of apparatus is applicable to

other problems where very weak light signals (several thousand photons total) must be photographed. (auth)

7975 AFCRC-TN-59-434

New Hampshire. Univ., Durham.

A COMPARISON OF THE COSMIC-RAY INTENSITY AT HIGH ALTITUDES WITH THE NUCLEONIC COMPONENT AT GROUND ELEVATION. J. C. Henkel, J. A. Lockwood, and J. H. Trainor. [1959]. 44p. Contract AF19(604)-1550. (AD-219618).

A series of balloon-borne soundings in the atmosphere with single Geiger tubes was made during the period January to September, 1958. The counting rate determined at the Pfotzer maximum is compared with that recorded by the nucleonic detector at Mt. Washington (1909 m; λ = 55°N). Large changes in the counting rate of each detector were observed, and the ratio of these changes is ~2:1. Several large deviations from this normal ratio were also observed. These deviations occur for flights on which the shape of the intensity-altitude curve near the Pfotzer maximum is quite different from the normal. These changes are explained in terms of either depressions of the low-energy portion of the cosmic-ray spectrum following marked decreases in the nucleonic component, or the presence of excess low-energy radiation. An anomalous increase of ~100% was observed at high altitudes during one flight and was attributed to high-energy x radiation. It is found that the hemispherical average unidirectional intensity above the atmosphere derived from the counting rate at the Pfotzer maximum has decreased ~200% from 1954 to 1958 at λ = 53°N, and this change is compared with results at other latitudes. (auth)

7976 AFOSR-TR-60-12

Dublin Inst. for Advanced Studies. School of Cosmic Physics.

TECHNICAL FINAL REPORT COVERING THE PERIOD DECEMBER 1, 1958 THROUGH NOVEMBER 30, 1959. 12p. Contract AF61(052)-163.

The variation in rate of local penetrating showers with solar time, the variation in rate of dense extensive air showers with solar time, and the variation in intensity of the primary particles causing extensive penetrating showers at sea level were investigated. Work was also done on the structure of extensive air showers, the performance of directional arrays, and the analysis of pressure variations produced by the atmospheric tides. (W.D.M.)

7977 T-305-R

ARTIFICIAL SATELLITE MEASUREMENTS OF COSMIC RADIATION. S. N. Vernov, N. I. Grigorov, Yu. I. Logachev, and A. E. (Ye.) Chudakov. Translated by E. R. Hope from Doklady Akad. Nauk S.S.S.R. 120, 1231-3(1958). 4p. (AD-207087). JCL.

This report has previously been abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 15630.

7978

ON THE LONG-TERM VARIATION IN THE COSMIC RADIATION. J. A. Lockwood (Univ. of New Hampshire, Durham). J. Geophys. Research 65, 19-25(1960) Jan.

From an analysis of cosmic-ray intensities recorded at Mt. Washington, Mt. Norikura, and Huancayo from 1954 to 1958, the long-term variation of intensity is interpreted as occurring in several sudden decreases rather than gradually. The largest changes of cosmic-ray intensity and in the ratios of intensities recorded by the three detectors followed the occurrence of large Forbush-type decreases. The depressed intensity following the rapid decrease of July 11, 1959, further supports this interpretation. Frequency distributions of the changes in nucleonic intensity from day to day show the importance of the Forbush decreases to the long-term variation. These results are discussed in terms of possible solar modulating mechanisms. (auth)

7979

DECREASE OF COSMIC-RAY INTENSITY ON FEBRUARY 11, 1958. J. A. Lockwood (Univ. of New Hampshire, Durham). J. Geophys. Research 65, 27-37(1960) Jan.

An analysis was made of cosmic-ray data recorded by the IGY network of stations during the sudden decrease of intensity on February 11, 1958. The unusual rapidity of the decrease, which was followed by a temporary recovery, provides a critical test for existing solar-controlled modulating mechanisms. The main decrease, occurring practically simultaneously over the earth, was relatively energy-insensitive. The subsequent temporary recovery appeared to be associated with a spatial anisotropy. It is suggested that these variations can be interpreted as the result of disordering the outer geomagnetic field by the solar wind, as first pointed out by Parker. (auth)

7980

GEOMAGNETIC EFFECTS ON COSMIC RADIATION FOR OBSERVATION POINTS ABOVE THE EARTH. Joseph E. Kasper (State Univ. of Iowa, Iowa City). J. Geophys. Research 65, 39-53(1960) Jan.

The theory of geomagnetic effects on cosmic radiation is discussed for the case in which the point of observation is above the surface of the earth. Parts of the older geomagnetic theory are readily modifiable for application under the new conditions; the manner in which ordinary Störmer theory and the Lemaitre-Vallarta theory of the main cone can be adapted is discussed. However, the simple shadow cones of Schremp appear now in a new light; as the point of observation rises from the earth, the simple shadow effect which exists at the earth makes a smooth transition to a new kind of earth's shadow effect. Associated with this effect are principal shadow cones which are defined by reference to the properties of certain families of trajectories. For observation points above the earth a modification in our view of the penumbral region is required; this is discussed very briefly. Extensive computations of principal shadow cones were carried out by machine integration of the equations of motion and subsequent abstraction of data from these trajectories. Sample computed cones are given for representative particle rigidities, geomagnetic latitudes, and altitudes of observation. The centered dipole approximation for the magnetic field of the earth is used throughout. (auth)

7981

SOLAR RADIO BURSTS AND LOW-ENERGY COSMIC-RAYS. A. R. Thompson and A. Maxwell (Harvard Coll. Observatory, Fort Davis, Tex.). Nature 185, 89-91(1960) Jan. 9.

The recent discovery, by equipment carried in satellites and balloons, that the terrestrial atmosphere is frequently bombarded by solar protons of energies 30 to 300 Mev is discussed. The origin of these low-energy cosmic rays and their relation to solar radio bursts, flares, and terrestrial disturbances are considered. An attempt is made to elucidate these problems from a consideration of radio spectral observations of the sun. (C.H.)

7982

LOW-ENERGY X-RAYS FROM INTERPLANETARY

SPACE. L. Reiffel (Armour Research Foundation, Chicago). Nature 185, 229(1960) Jan. 23.

It is pointed out that energy interchange processes between the heavy ions and the electrons of the plasma may be expected to occur in the region of hydromagnetic turbulence in space which should lead to a diffuse source of low-energy cosmic x rays which may be observable at altitudes greater than about 120 km. These x rays may be measured with rocket or satellite-borne proportional counters. The probable source, energy, and interactions of these x rays and equipment for measuring them are discussed. (C.H.)

7983

THE SOLAR DIURNAL VARIATION OF THE INTENSITY OF THE NUCLEONIC COMPONENT OF THE COSMIC RADIATION. P. L. Marsden and Qamrun Nessa Begum (Univ. of Leeds, Eng.). Phil. Mag. (8) 4, 1247-54(1959) Nov.

The diurnal variation of the intensity of the nucleonic component of cosmic radiation from 1954 through 58 was analyzed. The results, together with previously reported neutron data, show that the direction of the anisotropy causing the diurnal variation has remained substantially constant at 60 to 70° east of the line joining the earth to the sun except during 1954 when the direction changed abruptly to become west of the earth-sun line. The amplitude of the diurnal wave shows considerable variation, closer in correlation with the planetary amplitude of magnetic activity A_p than with relative sunspot numbers. (auth)

7984

COSMIC NEUTRINO RADIATION. Georg Marx and Nora Menyhárd (Roland Eötvös Univ., Budapest). Science 131, 299-300(1960) Jan. 29.

Various reactions which could result in the production of neutrino on the sun or a similar body are proposed. The possibility of determining the difference between a distant celestial body composed of common matter and a body composed of antimatter by observing their neutrino radiation is discussed. (C.J.G.)

Criticality Studies

7985 BAW-1179

Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.

THORIUM URANIUM PHYSICS EXPERIMENTS (TUPE). Monthly Report [for] October 1959. R. C. Anderson, M. L. Batch, R. H. Lewis, N. L. Snidow, and W. M. Vannoy. 27p. Contract AT(11-1)-766. OTS.

The Thorium–Uranium Physics Experiment (TUPE) is a study of uniform-lattice cores moderated with H_2O. The objectives of the TUPE project are: (1) to determine the critical size and mass for cores with M/W in the range 0.3 to 1.0 and for N_{O_2}/N_{25} = 25/1 and 15/1; (2) to determine nonleakage probability to allow determination of K_∞; (3) to separate k_∞ into fast and slow components; (4) to determine as many two-group parameters as possible in a critical experiment, including p_{O_2}, $\bar{\phi}$ water/$\bar{\phi}$ fuel, and k1/k2; and (5) to compare experimental results with predictions from various calculational models. A description of the cores, the status of the project, the results of calculations of the 25/1 lattices, and the results of measurements on Core 25 D are given. (W.D.M.)

7986 LA-1671

Los Alamos Scientific Lab., N. Mex.

BARE CRITICAL ASSEMBLIES OF ORALLOY AT INTERMEDIATE CONCENTRATIONS OF U-235. H. C. Paxton, G. A. Linenberger, L. L. Lowry, R. N. Olcott, J. D. Orndoff, and J. E. Sattizahn. May 1954. Decl. Jan. 4, 1960. 46p. Contract W-7405-eng-36. OTS.

Bare cylindrical critical assemblies were constructed of stacked plates of 93.4% enriched and natural uranium. Proportions were adjusted to give average U^{235} concentrations of 53.6, 37.7, and 29.0%. Approximate relations between critical parameters and U^{235} concentration were obtained. (W.D.M.)

7987 LA-2085

Los Alamos Scientific Lab., N. Mex.

CRITICAL ASSEMBLY OF URANIUM METAL AT AN AVERAGE U^{235} CONCENTRATION OF 16-1/4%. J. J. Neuer, G. E. Hansen, G. A. Jarvis, G. A. Linenberger, and D. S. Young. Oct. 1956. Decl. Jan. 4, 1960. 28p. Contract W-7405-eng-36. OTS.

A uranium metal critical assembly consisted of a 15-in. diameter core with an average U^{235} content of 16¼%, surrounded by a 3-in. thick natural uranium reflector. The critical mass was 692 kg of core material. (auth)

7988

ENRICHED-URANIUM HYDRIDE CRITICAL ASSEMBLIES. G. A. Linenberger, J. D. Orndoff, and H. C. Paxton (Los Alamos Scientific Lab., N. Mex.). Nuclear Sci. and Eng. 7, 44-57(1960) Jan.

Assemblies considered consist of approximate spheres of enriched-uranium hydride composition (approximating UH_3) in 8-in. thick normal uranium and nickel reflectors and in a uranium reflector with nickel liner. Data are of the following types: (1) critical sizes, (2) values of Rossi alpha in the neighborhood of delayed critical, (3) activation rates of various internal neutron detectors, and (4) reactivity coefficients of a variety of elements. From the reactivity coefficients at various radial positions, changes in critical mass corresponding to small changes in composition and density are computed. (auth)

Elementary Particles

7989 AFOSR-TN-59-1313

Cambridge Univ., England.

DISPERSION RELATION PREDICTIONS FOR π,p SCATTERING. Scientific Note No. 1. T. D. Spearman. Oct. 1959. 6p. Contract AF61(052)-233.

The dispersion relations for forward elastic π-p scattering are used to calculate the real parts of the forward scattering amplitude. It is found that using more accurate experimental data, the discrepancy observed by Puppi and Stanghellini can be resolved. A more precise value for the renormalized (π,N) coupling constant is predicted. (auth)

7990 AFOSR-TN-59-1324

Stanford Univ., Calif. Inst. of Theoretical Physics.

PION-PION SCATTERING IN THE φ^4 THEORY. Technical Note No. 9. M. Baker and F. Zachariasen. Dec. 1959. 24p. Project No. 9750-37500. Contract AF49(638)-388.

Pion-pion scattering was calculated using the determinantal method, assuming that a relativistic $(\lambda/4)(\varphi_i\varphi_i)^2$ coupling is responsible for the interaction. The scattering amplitude for the individual partial waves is expressed as a ratio of two power series and terms through λ^3 have been kept in each series. Numerical results for the S- and P-waves were obtained. The parameter λ is adjusted by attempting to fit the electromagnetic structure of nucleons. The best value of λ obtained by this fit is unfortunately so large that the validity of the determinantal approximation is doubtful. (auth)

7991 AFOSR-TN-59-1332

Stanford Univ., Calif. Inst. of Theoretical Physics.

SOME REMARKS ON COMPTON SCATTERING. Technical Note No. 8. J. D. Walecka. Dec. 1959. 13p. Project No. 9750-37500. Contract AF49(638)-388.

It is noted that no successful theory of nuclear Compton scattering exists. The best attempts at a theory combine the amplitude for photon scattering by Dirac particles with a point anomalous moment (this amplitude is known to be exact in the low-energy limit) with an amplitude which attempts to take into account the internal structure of the nucleon. A discussion of the first (Powell) amplitude is presented in a form which is useful in such relations. (J.R.D.)

7992 CX-42

New York Univ., New York. Inst. of Mathematical Sciences.

RELATIVISTIC COULOMB SCATTERING. Bernard Rosen. Apr. 1959. 66p. Contract AF19(604)-4555. (AFCRC-TN-59-293; AD-215933).

Contour integration is employed to evaluate analytically the correction terms to the Rutherford cross section for high energies. The sum of partial waves is replaced by an equivalent integral which is expanded in powers of the fine structure constant. Evaluation of the resultant integrals is performed wherever possible by use of integral representations for the transcendental functions appearing in the integrands; an unsuccessful attempt to determine the values of the integrals by the saddle point approximation is briefly sketched. Those terms which appear in the cross section to the fifth order in the fine structure constant are explicitly given by closed analytic expressions. The general form of the correction term corresponding to an arbitrary power of the fine structure constant is found in terms of two dimensional integrals involving elementary transcendental functions. A related problem, the non-relativistic scattering for an attractive $1/r^2$ potential, is also discussed. (auth)

7993 GAMD-470

General Atomic Div., General Dynamics Corp., San Diego, Calif.

THE ABSORPTION OF X-RAYS BY COLD MATERIALS. R. F. Christy. July 31, 1958. 3p. Project No. 52. Contract AF18(600)-1812.

Jönsson compiled x-ray absorption data (mostly on heavier elements and shorter wavelengths) and showed that a universal formula can be found which accurately reproduces the known experimental data provided the energies of the adsorption edges are known. This expression gives the absorption cross section as a universal function of λZ where λ is the wavelength and Z the atomic number. Equivalently the absorption is given as a function of $\hbar\omega/Z$. If $\hbar\omega$ is measured in Rydbergs, the absorption function is given for $\hbar\omega/Z$ ranging from about 1 to beyond the K edge. From this absorption formula the oscillator strength $df/(d(\hbar\omega))$ per unit energy can be deduced. The total oscillator strength of a heavy element, which is included in the region covered by the absorption function is about Z/2 or one-half of the total. An attempt is made to extrapolate the oscillator strength function from $\hbar\omega$ = Z Rydbergs to around 1 Rydberg in such a way as to give correctly the total oscillator strength and a few other averages. (auth)

7994 MRL-63

Watertown Arsenal. Materials Research Lab., Mass. and Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

A STUDY OF THE COMPTON SCATTERING OF X-RAYS. II. Li, Li^+, Be, Na, Na^+, Al^+, Al^{+3}, K^+, Cl^-, Ca, Ca^+, AND Ca^{+2}. A. J. Freeman. June 1959. 26p. DA Project 5-93-32-001. (AD-216628).

The Compton incoherent scattering functions for Li, Li^+, Be, Na, Na^+, Al^+, Al^{3+}, K^+, Cl^-, Ca, Ca^+, and Ca^{2+} were calculated using Hartree-Fock self-consistent-field wave functions. As was found earlier, the exchange terms in the Waller-Hartree expression are of considerable importance for obtaining accurate values of the incoherent scattering intensities. Comparison is made with earlier calculations and with the experiments of Laval on KCl, and Cribier on CaF_2. (auth)

7995 NASA-M-2-23-59E

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

A NUMERICAL METHOD FOR OBTAINING MONOENERGETIC NEUTRON FLUX DISTRIBUTIONS AND TRANSMISSIONS IN MULTIPLE-REGION SLABS. Harold Schneider. Feb. 1959. 56p. (AD-213531).

This method is investigated for semi-infinite multiple-slab configurations of arbitrary width, composition, and source distribution. A precise treatment for neutrons scattering isotropically in the laboratory system is presented. Adaptation of the numerical method for treating anisotropic scattering in slabs is indicated. For purposes of illustration, some simple slab problems are solved by the numerical method with isotropic scattering assumed. The results are compared with those of the spherical harmonics and Monte Carlo methods. (auth)

7996 NBS-TN-11

National Bureau of Standards, Washington, D. C.

PENETRATION OF GAMMA RAYS FROM ISOTROPIC SOURCES THROUGH ALUMINUM AND CONCRETE. Martin J. Berger and Lewis V. Spencer. May 11, 1959. 14p. (PB-151370). OTS.

Semi-analytical expressions, with numerically specified parameters, are given which represent the gamma-ray dose distribution in infinite aluminum or concrete media for sources that are monoenergetic (with energies between 10.22 and 0.0341 Mev), isotropic, and have the form of an infinite plane, point, disk, or spherical surface. (auth)

7997 TOI-58-27

Technical Operations, Inc., Burlington, Mass.

TRANSPORT OF RADIATION FROM A POINT SOURCE IN STRATIFIED SCATTERING MEDIA WITH REFLECTING BOUNDARIES. Alicia Lardé Nash. Nov. 1958. 34p. Contract DA29-044-XZ-587.

This investigation is a continuation of work on the multiple scattering of radiation from point sources by stratified media. The technique was extended to include the case of reflection at the boundary. Specific hand calculations were carried out for the two following cases: (1) A point source lying in the midplane of a uniform, isotropically scattering, non-absorbing plane slab cloud of thickness two mean free paths. The cloud is bounded on one side by a (Lambert) ground of albedo $\omega_0 = 0.4$ and by a vacuum on the other side. (2) A point source lying in the midplane of a uniform, non-absorbing plane slab cloud of thickness three mean free paths. The scattering is linear in cos Θ, and radiation crossing either boundary is considered to be lost. (auth)

7998 UCRL-5831-T

California. Univ., Livermore. Lawrence Radiation Lab.

POLARIZATION IN PION-NUCLEON SCATTERING AND THE SECOND AND THIRD PION-NUCLEON RESONANCES. Michael J. Moravcsik. Jan. 1960. 16p. Contract W-7405-eng-48. OTS.

The polarization of the recoil nucleon in pion-nucleon

scattering is studied from the point of view of providing a means of distinguishing among the various angular momentum assignments proposed for the higher pion-nucleon resonances. It is shown that polarization in this reaction is just as useful a guide as polarization in photoproduction. In particular, a measurement of the polarization at and in the neighborhood of 90° in the energy range between the first and third resonances should give a fairly convincing verification of one or the other of the prevailing assignments. (auth)

7999 AEC-tr-3967

ON THE QUESTION OF ELECTRICAL POLARIZABILITY OF NEUTRONS. Yu. (Iu.) A. Aleksandrov. Translated from a Russian report presented by the mission of scientists during their visit to Oak Ridge National Lab. in November 1959. 14p. (Includes original, 7p.). JCL or LC.

Under the influence of a strong electrical field the mesonic shell of the nucleon is deformed and an induced electrical dipole moment $\vec{p} = \alpha\vec{E}$ appears on the nucleon, where α is the polarizability coefficient of the nucleon. A theoretical analysis of various experiments on neutron scattering by heavy nuclei and photofission is presented. (W.D.M.)

8000 CEA-tr-A-647

EXCHANGES D'ENERGIE AU COURS DES CHOCS ENTRE CORPUSCULES. (Energy Exchanges during Collisions Between Particles). R. Döpel. Translated into French from Ann. Physik (5), 16, 1-38(1933).

A study was made of the light emitted from the He excited by a H beam at 2 to 40 kev. Excitation by protons was found to be negligible, and below 2 kev no He excitation occurred, but H is excited at least up to 500 v. The excitation of He by H atoms compares quantitatively with that of electrons. The excitation function cannot be taken as being a general energy function or as a function of the wavelength of the colliding particle. A qualitative analogy is found if one considers the excitation as a function of the velocity of the particle accomplishing the collision. An hypothesis based on the "transmittable" energy is proposed and other experiments suggested. (T.R.H.)

8001

ELEMENTARY SOLUTIONS OF THE TRANSPORT EQUATION AND THEIR APPLICATIONS. K. M. Case (Univ. of Michigan, Ann Arbor). Ann. Phys. (N. Y.) 9, 1-23(1960) Jan.

A method of treating problems involving the transport equation is discussed. Starting from Van Kampen's observation that it is sufficient that "solutions" be distributions, the elementary solutions of the homogeneous equation are considered. These are found to have completeness and, in some cases, orthogonality properties which lead to the solution of problems by a conventional eigenfunction expansion. The method is illustrated with the simplest examples of neutron diffusion, but it seems to be generally applicable. (auth)

8002

DENSITY EXPANSIONS OF HARD-SPHERE FERMI SYSTEMS. Aaron Temkin (Naval Research Lab., Washington, D. C.). Ann. Phys. (N. Y.) 9, 93-105(1960) Jan.

Aviles' calculation of the $\rho^{\frac{4}{3}}$ term in the expansion of the energy of a hard-sphere Fermi gas in one-third powers of the density ρ via the cluster expansion for the Jastrow wave function is completed. A similar type of density expansion is also applied to nuclear matter. (auth)

8003

THE LIFETIME OF THE Σ^+-HYPERON. M. F. Kaplon, A. C. Melissinos, and T. Yamanouchi (Univ. of Rochester, N. Y.). Ann. Phys. (N.Y.) 9, 139-68(1960) Jan.

The apparent discrepancy in the lifetime of the Σ^- hyperons in emulsions was investigated by using the $\Sigma^+ \rightarrow p + \pi^0$ decay mode. The method of maximum likelihood was used and a detailed description of its applications and limitations is given. Results of Monte Carlo calculations performed to test the consistency of the method are reported and are in complete agreement with the theoretical predictions. Estimates of the lifetime obtained by using decays in flight (DIF) only and both DIF and decays at rest yield different results which are statistically significant. The hypothesis of a double lifetime is not substantiated by the data and is rejected. Comparison with bubble chamber data is also made and it is concluded that the best value for the Σ^+-hyperon lifetime is $\tau = (0.70 \pm 0.15) \times 10^{-10}$ sec. Detailed data on 130 charged Σ-hyperons are presented in five tables. (auth)

8004

THE REFLECTION OF NEUTRONS OF VARIOUS ENERGIES BY PARAFFIN AND BY WATER. A. M. Kogan, C. G. Petrov, L. A. Chudov, and P. A. Yampolskii. Atomnaya Energ. 7, 385-6(1959) Oct. (In Russian)

Measurements were made of the magnitude and angular dependence of neutron reflections from a tissue-like substance in a wide range of energies. The ratio of the reverse neutron flux at various energies to the incident flux was found in order to determine the portion of the total number of neutrons absorbed by the substance. A special method was used for measuring small-dimension (point) neutron sources. Paraffin reflections of Po–Be neutrons (mean energy 5 Mev), Na–Be photoneutrons (0.83 Mev), Na–D photoneutrons (0.22 Mev), and Sb–Be photoneutrons (25 kev) were measured by one method. The second method was used for measuring the albedo of a slow-neutron beam emitted from a reactor. The neutron reflection factor for aqueous substances diminishes with the increase of energy; an increase of albedo is observed only with the change from thermal energies to energies of several electron volts. Using the data on angular dependence and the albedo value for conventional neutron incidence, the albedo for isotropic distribution was found to be 0.73, which is close to the standard 0.83 for neutron albedo in paraffin. (R.V.J.)

8005

THE NEUTRON ABSORPTION DENSITY DISTRIBUTION IN PARAFFIN. A. M. Kogan, G. G. Petrov, L. A. Chudov, and P. A. Yampolskiĭ. Atomnaya Energ. 7, 386-8(1959) Oct. (In Russian)

Neutron tissue dosage can be partially determined by the energy released during neutron capture. The spatial distribution of neutron absorption by paraffin was studied in an effort to determine the capture component. A wide neutron beam with conventional incidence to the surface was measured for various cross sectional dimensions of the paraffin block. Neutron densities were measured with thin magnesium foils. The absorption density distribution in depth was measured for the following incident neutrons: Cd and Cd + B filtered neutrons; Sb–Be, Na–D, and Na–Be photoneutrons; and d–d and Po–Be reaction neutrons. The maximum statistical error in measuring the foil activity did not exceed 3%. (R.V.J.)

8006

VARIATION WITH PARTICLE SIZE OF THE EFFECTIVE X-RAY ABSORPTION COEFFICIENT OF HETEROGENEOUS SLABS. G. B. Mitra and A. J. C. Wilson (University Coll., Cardiff, Wales). Brit. J. Appl. Phys. 11, 43-5(1960) Jan.

The effective absorption coefficient for transmission of x rays through heterogeneous slabs differs from the weighted-mean absorption coefficient because of random fluctuations in the number of particles of each type of material along different parallel paths. The value of μ_{eff} is calculated for several models; for each it is less than $< \mu >$, the difference becoming large for large particles. (auth)

8007

ON THE RELATION BETWEEN THE METHOD OF SPHERICAL HARMONICS AND THE METHOD OF DISCRETE COORDINATES. Ladislav Trlifaj. Czechoslov. J. Phys. 9, 535-43(1959). (In Russian)

The relation between the method of spherical harmonics and the method of discrete coordinates is studied from the point of view of the integral Boltzmann equation for neutron diffusion problems which have full plane and cylindrical symmetry. (auth)

8008

EXPERIMENTAL INVESTIGATION ON ANGULAR DISTRIBUTION OF ELECTRONS FROM μ-MESON DECAY. Miroslav Friml. Czechoslov J. Phys. 9, 552-6(1959). (In Russian)

A description is given of the measurement of the angular distribution of electrons from μ-meson decay. The results of the measurements confirm that the angular distribution is asymmetrical, as required by the hypothesis of parity non-conservation in weak interactions of elementary particles. The asymmetry of the measured electron distribution from μ-meson decay is discussed. (auth)

8009

SOME APPLICATIONS OF THE VARIATIONAL METHOD FOR THE NEUTRON THERMALIZATION PROBLEMS. A. Shimizu (Nippon Atomic Ind. Group Co., Ltd., [Tokyo]). J. Atomic Energy Soc. Japan 1, 376-84(1959). (In Japanese)

Two forms of variational expressions are developed for the neutron energy spectrum and the effective reaction rate and its temperature coefficient in the thermal region with "Monoatomic Heavy Gas Models." Using the first form of variational expressions, the upper and lower limit of neutron thermal spectrum was obtained with the above mentioned model. The effective thermal cross section and its temperature coefficient are obtained as an extremum of functional in another form of variational expressions, and the limit of the validity of neutron temperature as a parameter expressing the deviation from Maxwell distribution is discussed. (auth)

8010

ANNIHILATION OF POSITRONS IN ORGANIC LIQUIDS. C. R. Hatcher, T. W. Falconer, and W. E. Millett (Univ. of Texas, Austin). J. Chem. Phys. 32, 28-31(1960) Jan.

The mean life τ_2 and fraction I_2 of positrons which form ^3S positronium were measured for annihilation in 20 organic liquids—alcohols, glycols, acids, benzene derivatives, and others. By using the measured value of τ_2, it is possible to calculate $(\sigma v)_{Av}$ where σ is the molecular cross section for annihilating ^3S positronium on collision and v is the velocity of the positronium atom. The results show that in general $(\sigma v)_{Av}$ is related to the "size" of the molecule although there are some consistent exceptions to this rule. There is also a rough correlation between τ_2 and density, τ_2 being shortest for the most dense liquids and longest for the least dense ones. (auth)

8011

ELASTIC AND INELASTIC SCATTERING OF LOW-VELOCITY D^+ AND D_2^+ IN DEUTERIUM. W. H. Cramer and A. B. Marcus (Univ. of Florida, Gainesville). J. Chem. Phys. 32, 186-8(1960) Jan.

Results are presented of the measurement in the energy range 4 to 400 ev of elastic and charge exchange cross sections for D^+ and D_2^+ ions in D_2. Ordinary ionization was not observed. Charge exchange was detected above 65 ev for D^+ in D_2 and over the entire range of energies for D_2^+ in D_2. The present results are compared with measurements of collisions of hydrogen ions in H_2. (auth)

8012

APPROACH TO EQUILIBRIUM OF A LARGE FERMION SYSTEM. Kyoji Nishikawa (Univ. of Tokyo). J. Phys. Soc. Japan 15, 78-92(1960) Jan.

Using Feynman diagrams, the dissipative behavior of a large quantum system of many fermions is discussed. On the basis of linked cluster expansion of the time-dependent perturbation theory, the master equation is derived for the time sufficiently long compared to the effective collision time and for a slowly varying initial distribution in the momentum space. Van Hove's result for weak coupling limit and the equation for low density limit are obtained as special cases. (auth)

8013

INTERVALLEY SCATTERING OF HOT ELECTRONS. Motoichi Shibuya and Wataru Sasaki (Electrochemical Lab., Tokyo). J. Phys. Soc. Japan 15, 207-8(1960) Jan.

In high electric fields the electron temperature of the ith valley T_i becomes different from those of other valleys when the directions of the principal axes of the effective mass tensor are different in each valley. Derivations are presented for the intervalley scattering of electrons, the valley temperatures, and the drift velocity. The results obtained for n-type Ge at room temperature are show... (B.O.G.)

8014

SCHWINGER'S MESON AND THE μ-MESIC ATOM. I. R. Gatland (Imperial Coll., London). Nuclear Phys. 14, 205-11(1959) Dec. (2).

The properties of Schwinger's meson (σ), which is supposed to interact with muons and cascade particles, were estimated by calculating: the muon self mass and comparing this with the muon-electron mass difference, the anomalous effect on the bound state levels of μ-mesic atoms and comparing this with the experimental data. These and other results were used to obtain values of the σ-meson mass and the strength of its coupling to muons and baryons. (auth)

8015

NEUTRAL MESON PRODUCTION BY 930 Mev PROTONS. A. M. Segar and R. Rubinstein (Univ. of Birmingham, Eng.). Nuclear Phys. 14, 222-31(1959) Dec. (2).

The production of neutral mesons in proton reactions on aluminum and carbon targets was studied using total absorption Cherenkov counters. Total cross sections for π^0 production from carbon at 930 and 660 Mev were 69 ± 14 and 21 ± 9 mb. The angular distribution of gamma rays, in the nucleon-nucleon center of mass at 930 Mev, was $1 - (0.2 \pm 0.3) \cos\theta + (0.9 \pm 0.3) \cos^2\theta$. From this the angular distribution of mesons in proton-nucleon collisions was found to be $1 + (2.6 \pm 1.6) \cos^2\theta$. (auth)

8016

WIGNER'S INEQUALITIES FOR RELATIVISTIC SCATTERING. P. Menotti (Università, Pisa, Italy). Nuclear Phys. 14, 232-7(1959) Dec. (2).

Wigner's inequalities for the momentum derivatives of the scattering phases are extended to the relativistic scat-

tering of particles of spin zero and one half by a central potential of finite range. (auth)

8017

COUPLED ERRORS ON SCATTERING PHASE SHIFTS. Douglas Miller (Harvard Univ., Cambridge, Mass.). Nuclear Phys. 14, 238-42(1959) Dec. (2).

During a least squares analysis of scattering data, an hypothetical energy dependence for the phase shifts often reduces the errors considerably. The mechanism of this error reduction becomes explicit only when the grid method of searching for a best fit is employed. For illustration, calculations are taken from low energy counter measurements on the pion nucleon system. (auth)

8018

A GENERALIZATION OF THE IMPULSE APPROXIMATION IN FIELD THEORY. F. Kaschluhn (Joint Inst. for Nuclear Research, Dubna, USSR). Nuclear Phys. 14, 314-38(1959) Dec. (2). (In German)

A generalization of Chew's impulse approximation in field theory is proposed which may be used for an explicit evaluation of the contribution from the non-observable region in the dispersion relations for pion-deuteron scattering. The Hamilton-formalism for a non-relativistic two-nucleon system is assumed with a pseudovector coupling to the pion field for which the usual cut-off is used. The generalization to the case of more than two nucleons and to other couplings is obvious, and it should also be possible, with appropriate modifications, to extend the method to the relativistic case. The time-dependent scattering formalism is employed, i.e., the S-matrix describes transitions between the bare states of the two-nucleon system, which are defined as the projections of the corresponding real states onto the meson vacuum. This leads directly to the introduction of a field-energy operator which involves self-energies and interaction between the nucleons, and by means of which it is possible to avoid the difficulties associated in general with the bound state problem in quantum field theory. It is shown that the higher approximations to the impulse approximation correspond, also in field theory, to the potential scattering and multiple scattering corrections, which also include the absorption phenomena. (auth)

8019

DEPOLARIZATION OF μ-MESONS BY AUGER-CAPTURE IN HYDROGEN. J. von Behr and H. Marschall (Universität, Freiburg i.B.). Nuclear Phys. 14, 342-8(1959) Dec. (2). (In German)

Depolarization of polarized muons by Auger-capture in hydrogen atoms was estimated. Assuming that the velocity of the muons is distributed randomly with respect to the center of capture, the degree of polarization of the captured muons is found to be approximately $\frac{1}{3}$. (auth)

8020

K-HYPERON PRODUCTION THRESHOLD PHENOMENA. L. Fonda and R. G. Newton (Indiana Univ., Bloomington, Ind.). Nuovo cimento (10) 14, 1027-50(1959) Dec. 1. (In English)

The energy dependence of pion-proton scattering and K-meson-hyperon production cross sections were studied on the basis of a simple model. It was found that the threshold effects can be big enough to be experimentally detectable for the purpose of determining relative hyperon and K-meson parities. (auth)

8021

RELATIVISTIC DEUTERON WAVE FUNCTION. [PART] I. M. Gourdin (Ecole Normale Supérieure, Paris and Faculté des Sciences, Bordeaux) and J. Tran Thanh Van (Ecole Normale Supérieure, Paris). Nuovo cimento (10) 14, 1051-64(1959) Dec. 1. (In English)

Utilizing the Bethe and Salpeter equation, a non-relativistic deuteron wave function was calculated in an euclidian energy–momentum space employing a partial wave expansion with four-dimensional hyperspherical harmonics. By Fourier transformation the wave function was obtained in a configuration space. An explicit numerical expression was obtained by the form of the interaction kernel. A repulsive effect due to relativistic corrections was observed which shows the existence of a hard core. (C.J.G.)

8022

A REMARK ON THE UNITARITY PROPERTY OF THE SCATTERING OPERATOR. T. Kato and S. T. Kuroda (Univ. of Tokyo). Nuovo cimento (10) 14, 1102-7(1959) Dec. 1. (In English)

An example of a scattering system with the following properties is constructed: the unperturbed Hamiltonian possesses no bound states, the wave operators exist, and the scattering operator is not unitary. It is shown that the existence of the wave operators does not in general imply the unitarity property of the scattering operator. (auth)

8023

QUANTIZATION OF THE TWO-COMPONENT FERMION THEORY. M. Tonin (Università, Padua and Istituto Nazionale di Fisica Nucleare, Padua). Nuovo cimento (10) 14, 1108-19(1959) Dec. 1. (In English)

The two-component fermion field satisfying a second order Pauli wave equation was quantized. Anticommutation rules for the two-component spinors describing the fermion field were derived. The possibility of extending Wick's theorem to this case was shown, and rules for calculating the Feynman diagrams were obtained which are strictly closed to the rules for the quantum electrodynamics of Klein-Gordon particles. (auth)

8024

PARITY NON-CONSERVATION IN PION PRODUCTION. D. Lurié and E. A. Power (European Council for Nuclear Research, Geneva). Nuovo cimento (10) 14, 1145-8(1959) Dec. 1. (In English)

Using the method of Weizsäcker-Williams the pion production asymmetry in the scattering of pions on oriented nucleons due to a possible parity violation in the pion-nucleon interaction was calculated. An upper bound for the asymmetry was obtained using the upper bounds for the parity violation in pion-nucleon scattering calculated by Fubini and Walecka in the assumption of the maximum parity violation in K-production. The result obtained is not inconsistent with the result of a recent pion production experimental results. (auth)

8025

CAUSALITY COMPLEMENTARITY AND S-MATRIX FORMALISM IN A NON-LOCAL RELATIVISTIC THEORY OF FIELDS. G. Wataghin (Università, Turin). Nuovo cimento (10) 14, 1157-65(1959) Dec. 1. (In English)

A formalism of a non-local theory is suggested which describes point-interactions and point particles by interactions taking place in certain 4-dimensional domains and by an approximate description of propagation of fields representing extended physical particles. The conditions of relativistic invariance and of macroscopic causality are compatible with the above limitations because the interactions can be described by the S-matrix in p-space and studied independently from the propagation problem. (auth)

8026

A DIRECT CONSEQUENCE ARISING FROM THE RELATIVISTIC HANDLING OF AN "UNIFORM" FIELD. I. Gottlieb (Université, Jassy). Nuovo cimento (10) 14, 1166-70(1959) Dec. 1. (In English)

A relativistic correction to the trajectory of a particle in a uniform gravitational field, the correction term found in Schwarzschild's metrics on the relativistic theory of gravitation, was derived from a classical point of view. The metric employed corresponds to a symmetry toward any straight line, parallel to the Ox axis with the field corresponding to a classical uniform field at the exterior of the masses of charge which created it. (C.J.G.)

8027

EXPERIMENTAL EVIDENCE FOR THE DECAY MODE $\Sigma^+ \rightarrow p + \gamma$. G. Quareni and A. Quareni Vignudelli (Università, Bologna and Istituto Nazionale di Fisica Nucleare, Bologna) and G. Dascola and S. Mora (Università, Parma, Italy). Nuovo cimento (10) 14, 1179-80(1959) Dec. 1. (In English)

From ~1500 K^- captures at rest in photographic emulsion, evidence was found for three events of the hyperon decay mode $\Sigma^+ \rightarrow p + \gamma$. (C.J.G.)

8028

A NON-MESONIC DECAY OF A $_{\Lambda}B^{11}$ HYPERFRAGMENT. D. Evans, B. D. Jones, and J. Zakrzewski (H. H. Wills Physics Lab., Bristol, Eng.). Phil. Mag. (8) 4, 1255-9 (1959) Nov.

An event is described which is interpreted as the non-mesonic decay of $_{\Lambda}B^{11}$ into Li^8, a deuteron and a proton. Any other interpretation is seen to have a negligible probability of being correct. The binding energy of the Λ^0-hyperon in the $_{\Lambda}B^{11}$ hypernucleus is found to be 11.3 ± 0.8 Mev. (auth)

8029

THE THEORY OF SPIN WAVES. M. A. Gintsburg. Phys. and Chem. Solids 11, 336-8(1959) Oct.

The manner in which electromagnetic waves pass into spin waves as the wavelength decreases was investigated. The conception that, as $\lambda \rightarrow 0$, the wave number increases, the phase velocity decreases, and the electromagnetic waves change continuously into spin waves is valid only if no losses occur. The smallest losses occur in garnets, while in ferromagnetics the losses are considerable. As the wave number, k, increases, the electromagnetic wave approaches the spin-wave region through a damping process. The theory is investigated further to include the propagation of spin and electromagnetic waves in yttrium garnet, $Y_3Fe_2(FeO_4)_3$. (B.O.G.)

8030

RADIATION PRODUCED BY AN ELECTRON BEAM PASSING THROUGH A DIELECTRIC MEDIUM. Jacob Neufeld (Oak Ridge National Lab., Tenn.). Phys. Rev. 116, 785-7 (1959) Nov. 15.

An electron beam passing through a dielectric medium may produce an instability that is associated with the growth of longitudinal waves having a velocity close to the velocity of the beam. For a transparent dielectric medium this instability occurs if the frequency ω of these waves satisfies the following condition: $\omega_1^2 < \omega^2 < \omega_1^2 + \omega_0^2$, where ω_1 is the frequency of bound oscillators in the dielectric medium and $\omega_0 = (4\pi ne^2/m)^{1/2}$, where n is the electron density. If inhomogeneities are present these longitudinal waves may be converted into transverse waves and radiated into space. Thus, there is a possibility of a luminous effect at "Bohr frequencies" that differ from the Vavilov-Cherenkov frequencies. (auth)

8031

PLUVINAGE METHOD FOR SYSTEMS OF THREE CHARGED PARTICLES. Larry Spruch and Martin Kelly (New York Univ.). Phys. Rev. 116, 911-13(1959) Nov. 15.

A method due to Pluvinage for finding ground-state energies of two-electron systems was studied. His choice of a trial function, Ψ_k, is of interest since $H\Psi_k$, where H is the Hamiltonian, is free of singularities. His calculations were done numerically. It was found possible to utilize the method in such a way that, with little loss in accuracy, the various calculations can be performed analytically. With a trial function which contains no variational parameters, the method just fails to give a bound state for H^-. (The results for Z greater than unity are quite accurate.) The introduction of a scaling factor gives a bound state. Thus, only one variational parameter is required to prove the existence of a bound state, as compared with the two parameters required for a Hylleraas-type trial function. However, the calculations are much more tedious. The method was generalized to be applicable to an arbitrary system of three charged particles which interact only through their Coulomb fields. It was applied to the proton, proton, μ^- system, but it does not give very useful results there. (auth)

8032

SCATTERING OF ELECTRONS BY NEUTRAL ATOMS. Bernard A. Lippmann and Marvin H. Mittleman (Univ. of California, Livermore) and Kenneth M. Watson (Univ. of California, Berkeley). Phys. Rev. 116, 920-25(1959) Nov. 15.

A recent reformulation of the theory of electron scattering by atoms—in which those scatterings, real or virtual, that leave the state of the atom unchanged are separated off from the remainder—was generalized to include the effects of the Pauli principle. The case where the Hartree approximation suffices to describe the atom is considered in detail, including a calculation of the "scattering potential" to second order. (auth)

8033

ELASTIC SCATTERING OF LOW-ENERGY ELECTRONS BY ARGON. B. Kivel (AVCO-Everett Research Lab., Everett, Mass.). Phys. Rev. 116, 926-7(1959) Nov. 15.

The partial-wave Schroedinger equation was integrated numerically for a potential adjusted so that the predicted elastic scattering is in agreement with measurements by Ramsauer and Kollath. The cross section at zero energy is found to be 8×10^{-16} cm^2 which is appreciably above the minimum value of 0.3×10^{-16} cm^2 at 0.4 ev. The high value at zero energy, which results from the tail of the polarization force, will be reduced at densities of one atmosphere and above, because the field is cut off by neighboring atoms. Application of the method to predict the eigenvalues of the excited bound states of potassium indicates the validity of the static potential and that the exchange force decreases with increasing angular momentum. (auth)

8034

PROTON-PROTON SCATTERING AT 10 Mev. L. H. Johnston and D. E. Young (Univ. of Minnesota, Minneapolis). Phys. Rev. 116, 989-91(1959) Nov. 15.

Differential cross sections were measured for scattering of 9.69-Mev protons by hydrogen gas, covering the laboratory angular range from 45° to 5°. The angular resolution is ±½° at small angles, and estimated absolute probable errors ±0.7% except at the smallest angles. The interference minimum of 51.4 millibarns occurs at 34° c.m. and the 90° cross section is 54.6 mb. The data can

be fit with the following set of phase shifts: $^1S_0 = 54°$, $^3P_0 = +2.83°$, $^3P_1 = -5.07°$, $^3P_2 = +2.22°$, $^1D_2 = +0.2°$. (auth)

8035

ANGULAR CORRELATION OF Cd^{114} GAMMA RAYS IN SINGLE CRYSTALS OF INDIUM. Arthur G. Duneer, Jr. (Rensselaer Polytechnic Inst., Troy, N. Y.). Phys. Rev. 116, 999-1000(1959) Nov. 15.

The measured values of the angular correlation function at $\theta = 150°$ were consistent with the statistical deviation of the mean of ± 0.005 for six measurements with different azimuthal angles between the c axis of an indium metal crystal and the direction of the fixed counter. The electric field gradient at the position of the decaying Cd^{114} nucleus was calculated using a Fermi-Thomas type calculation with account being taken of the antishielding effect of the atomic core electrons. (auth)

8036

ELASTIC π^+-p AND p-p SCATTERING AT 1.23 Bev/c. L. O. Roellig and D. A. Glaser (Univ. of Michigan, Ann Arbor). Phys. Rev. 116, 1001-7(1959) Nov. 15.

Elastic π^+-p scattering at 1.1 Bev and elastic p-p scattering at 582 Mev were measured using a propane bubble chamber. On the basis of 661 identified π^+-p elastic scatterings found in the scanning of 1.726×10^6 cm of pion track, the total elastic cross section is found to be 12.3 ± 1.2 mb. The differential cross section is rather isotropic at large angles and exhibits a strong peak for small forward scattering angles. If the forward peak is interpreted as diffraction scattering according to the optical model, the data are best fitted by a proton with a π^+-p interaction radius, $R = (0.99^{+0.13}_{-0.11}) \times 10^{-13}$ cm and an opacity, $O = 0.70^{+0.06}_{-0.07}$. The total cross section for p-p elastic scattering at 582 Mev was found to be 24.2 ± 1.6 mb on the basis of 2442 elastic scatterings observed in the scanning of 3.000×10^6 cm of proton track. Both differential and total p-p cross sections are in excellent agreement with the results of counter experiments in this energy region. (auth)

8037

DIRECT PAIR PRODUCTION BY MUONS. Byron P. Roe and Seinosuke Ozaki (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 116, 1022-7(1959) Nov. 15.

A measurement was made of the direct pair production cross section for muon primaries between about 8 and 120 Bev. The muons were selected by a magnetic spectrometer and interactions were observed in a multiplate expansion cloud chamber. Results indicate that in the transferred-energy range above about 200 Mev the direct pair cross section is somewhat less than that predicted by the Murota-Ueda-Tanaka theory. This result does not, however, necessarily indicate any breakdown of fundamental electromagnetic theory. Possible theoretical inadequacies are discussed in the text. (auth)

8038

UPPER BOUNDS ON SCATTERING LENGTHS FOR STATIC POTENTIALS. Larry Spruch and Leonard Rosenberg (New York Univ.). Phys. Rev. 116, 1034-40(1959) Nov. 15.

It is shown that in the zero-energy scattering of a particle by a center of force, where no bound state exists, the Kohn variational principle provides an upper bound on the scattering length. A bound may also be obtained from Hulthén's method, although with the same form of trial function the Kohn result will be lower (and therefore better) than the one obtained from the Hulthén principle. The Rubinow formulation need not provide a bound; for those calculations which were performed in this form, the results may be converted without any further calculations so that they correspond to the Kohn form, and therefore, under the circumstances considered, do give a bound. Analogous results hold for states of nonzero orbital angular momentum. Direct generalizations of the above results are valid for scattering by a compound system. (auth)

8039

COMMENTS ON FARAGO'S TREATMENT OF SPIN PRECESSION IN CROSSED MAGNETIC AND ELECTRIC FIELDS. V. L. Telegdi and R. Winston (Univ. of Chicago). Proc. Phys. Soc. (London) 74, 782-6(1959) Dec. 1.

In the case of a particle changing its polarization when moving on a trochoidal orbit in crossed magnetic and electric fields, Farago contended that Ω/ω is an invariant, i.e., has the same numerical value as in the (printed) frame where the field is purely magnetic. Through the use of Lorentz transformations, it is verified that this contention is incorrect, and that the ratio (Ω/ω), like ω itself, varies along the loops of the trochoidal orbit. (C.J.G.)

8040

MULTIPOLE MODEL OF ELEMENTARY PARTICLES. [PART] I. PION–BARYON INTERACTIONS. Daisuke Ito (Tokyo Univ. of Education); Shigeo Minami (Osaka City Univ.); and Hiroshi Tanaka (Yokohama National Univ. Japan). Progr. Theoret. Phys. (Kyoto) 22, 159-67(1959) Aug.

A simple model is presented for a unified understanding of elementary particles phenomena. In the case of the pion-baryon system the strong interaction is interpreted as the monopole interaction and the weak interaction as the dipole interaction between pions and structured baryons of order 10^{-20} cm. The nature of the weak interaction is discussed on the basis of the multipole model. (auth)

8041

MULTIPOLE MODEL OF ELEMENTARY PARTICLES. II. NON CONSERVATION OF PARITY AND BARYON-LEPTON INTERACTIONS. D. Ito and M. Yamazaki (Tokyo Univ. of Education); H. Tanaka (Yokohama National Univ., Japan); and Y. Takahashi (Univ. of Science, Tokyo). Progr. Theoret. Phys. (Kyoto) 22, 168-76(1959) Aug.

The problems of the non-conservation of parity and the universal Fermi interaction are discussed on the basis of the multipole model. The non-conservation of parity comes from the asymmetric structure in the small region of order 10^{-20} cm. The coupling length, $l \sim 10^{-17}$ cm, in β-decay is derived from the interaction of the zitterbewegung baryons and extended leptons of order 10^{-20} cm. Its coupling becomes, however, of axial vector type instead of vector-axial vector type. (auth)

8042

MAXIMAL WEAK INTERACTIONS. Ko Aizu (Rikkyo Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 22, 192-206(1959) Aug.

All possible weak processes are systematically enumerated, and the hypothesis of maximal set of interactions (that there is always the weak interaction among any combination of all kinds of particles) is investigated. It is found that this maximal interaction model is equivalent to the minimal interaction model in the sense that the experimental facts are described equally well by these two models, provided that a selection rule which forbids at least the appearance of μ-e pair is added to the former model. (auth)

8043

REMARKS ON THE FINAL STATE INTERACTION IN FERMI'S THEORY OF MULTIPLE PARTICLE PRODUC-

TION. Shin Ishida (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 207-12(1959) Aug.

A method of modifying Fermi's statistical formula of multiple particle production is presented. It consists of expressing the "matrix element" of Fermi's theory as an integration of a plane wave in the effective interaction volume, and then replacing this free state wave function by that of interacting particles. Its application to the π-N system and deuteron production is given. Belenky's formalism on the same problem is critically discussed. (auth)

8044

ELECTROMAGNETIC STRUCTURE OF THE NUCLEON. [PART] I. Kichiro Hiida, Noboru Nakanishi, and Masayuki Uehara (Kyoto Univ.), and Yukihisa Nogami (Univ. of Osaka Prefecture, Sakai, Japan). Progr. Theoret. Phys. (Kyoto) 22, 247-73(1959) Aug.

The electromagnetic structure of the nucleon is investigated in detail. For its isovector part, the distribution functions of charge and anomalous magnetic moment are obtained with use of two different methods, the second order relativistic perturbation and the static approximation. The S-wave and recoil effects and higher order corrections are examined by comparing these results. The meson structure correction in the fourth order perturbation is also calculated, and it is shown that its contribution is rather small. As for the isoscalar part, the 3π-state contribution is calculated by the lowest order perturbation (order g^6) for which a rough numerical evaluation is carried out. Hyperon closed loop effects are also discussed. (auth)

8045

THE TRIPLET ODD STATE POTENTIAL OF THE TWO-NUCLEON SYSTEM. T. Hamada (Sydney Univ.); J. Iwadare (Kyoto Univ.); S. Otsuki (Nagoya Univ., Japan); R. Tamagaki (Hokkaido Univ., Japan); and W. Watari (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 22, 301-4(1959) Aug.

Predicted phase shifts of nucleon–nucleon scattering at 90 and 150 Mev are given. Triplet odd state potentials were proposed for the two-nucleon system. The shapes of the proposed potentials were quite similar to that of the two-pion exchange potential which suggests the qualitative validity of the static pion theoretical potential at these high energies. (C.J.G.)

8046

ON THE RADIATIVE MUON DECAY. Shoji Sawada and Minoru Yonezawa (Hiroshima Univ.). Progr. Theoret. Phys. (Kyoto) 22, 309-10(1959) Aug.

Davis et al. reported a search for the event $\mu \rightarrow e + \gamma$ and obtained the value $\sim 10^{-5}$ as the upper limit of the branching ratio $\mu \rightarrow e + \gamma/\mu \rightarrow e + \nu + \bar{\nu}$. Calculations were made which suggest that most of the events observed by Davis et al. should be interpreted as the internal bremsstrahlung of muon decay ($\mu \rightarrow e + \nu + \bar{\nu} + \gamma$), and the process $\mu \rightarrow e + \gamma$ may be less frequent. (C.J.G.)

8047

RADIATION OF A MODULATED BEAM OF CHARGED PARTICLES WHILE PASSING THROUGH A ROUND HOLE IN AN IDEALLY CONDUCTIVE FLAT SCREEN. J. N. Dnestrovskii and D. P. Kostmoarov (Lomonosov Moscow State Univ.). Radiotekh. i Elektron. 4, 1644-51(1959) Oct. (In Russian)

Electromagnetic radiation emitted by modulated electron beams passing through an opening in an ideally conducting plane screen is analyzed. The problem is reduced to the integral first-order Fredholm equation which is numerically solved for the velocity range from $\beta = 0.1$ to 0.99. (R.V.J.)

8048

ELECTRON WAVES AND THEIR INTERACTION WITH THE FIELD OF WAVEGUIDE SYSTEMS. V. A. Solntsev and A. S. Tager. Radiotekh. i Elektron. 4, 1652-9(1959) Oct. (In Russian)

Propagation of a small high-frequency signal in a rectilinear electron flux with periodically changing velocity was investigated. The velocity and electron wave amplitudes of the current and the conditions of their growth along the beam are determined. The interactions of space harmonics of a current with slow and fast electromagnetic waves were analyzed as well as the interactions of space harmonics of two-electron flux current. (tr-auth)

8049

ON THE POTENTIAL MOVEMENT OF CHARGED PARTICLES. V. T. Ovcharov. Radiotekh. i Elektron. 4, 1741-7 (1959) Oct. (In Russian)

In previous work it was shown that by introducing a suitable orthogonal coördinate system into calculations for determining the potential distribution within an electron beam with assigned trajectories, it is possible to reduce the problem to the solution of a standard differential equation of the second order. However, such an orthogonal system limits the analysis to potential motion within limited trajectories. An analysis is made of Lamé coefficients, and necessary and sufficient conditions are developed for charged particle potential motion within the orthogonal frame of reference. (R.V.J.)

8050

RADIATION FROM HIGH-SPEED PARTICLES. P. A. Cherenkov (Inst. of Physics, Academy of Sciences, Moscow). Science 131, 136-42(1960) Jan. 15.

The theory of the weak visible radiation produced in a solvent by the action of gamma rays is discussed. It is shown why this phenomenon cannot be interpreted as luminescence. The radiation exhibited a property of extremely pronounced spatial asymmetry which lead to the theory that the radiation is produced by electrons which move uniformly in the substance with a velocity which exceeds the phase velocity of light in this medium. Angular distributions of the radiation intensity were determined for four liquids. The value of the angle was found to increase with increase in the index of refraction of the solvent. The measurement of the intensity of the radiation by the proper electronic circuit is discussed. Applications of the radiation in particle detectors, in the study of broad cosmic showers, and in the measurement of energy are discussed. (C.J.G.)

8051

GENERAL CHARACTERISTICS OF VAVILOV-CHERENKOV RADIATION. I. E. Tamm (Inst. of Physics, Academy of Sciences, Moscow). Science 131, 206-10(1960) Jan. 22.

The theory of radiation moving at superlight velocities is explained and fundamental equations which describe the general characteristics of the radiation are given. The energy losses of a charged particle moving in a plasma in the absence of external magnetic fields are discussed. The absorption of plasma waves in the plasma itself is shown to be conditioned by a reverse Cherenkov effect. The methods of heating plasma by an external beam of fast charged particles and by magneto-acoustic waves are described. (C.J.G.)

8052

ON DETERMINING THE RADIUS OF MESON-NUCLEON

INTERACTION. V. I. Malchenko (Dnepropetrousk State Univ., Ukrainian SSR). Ukrain. Fiz. Zhur. 4, 432-7(1959) July-Sept. (In Ukrainian)

The dispersive relationships for potential scattering of nonrelativistic particles obtained by Khuni (Phys. Rev. 107, 1148(1957)) is considered in application to potentials of the type $V(r) \sim e^{-\alpha r}$, $\alpha > 0$, having a particuliarity at zero not exceeding $1/r$. If the estimates for the transmission pulse in meson-nucleon scattering are applied, it is determined that the radius of meson-nucleon interaction $\rho_0 \leq 0.86 \cdot 10^{-13}$ cm. (auth)

8053

CALCULATION OF THE CONTRIBUTION TO THE MESIC ATOM STATE OF "NON-PHYSICAL" REGION DISPERSION RELATIONS FOR MESON SCATTERING BY THE NUCLEUS. Yu. P. Shcherbin. Vestnik Leningrad. Univ. Ser. Fiz. i Khim. No. 22, 64-9(1959). (In Russian)

The corrections to the forward dispersion relations for pion-nucleon scattering due to the second mesoatomic intermediate state are considered. The calculations were performed approximately in the frame of the static theory of pion-nucleon interaction. These corrections were shown to diminish the divergence between the experimental and theoretical data for the energy near to the resonance only by 4%. (auth)

8054

THEORY OF ELECTRONS. [PART] V. Walter Wessel (Universität, Heidelberg, Ger.). Z. Naturforsch. 14a, 1005-14(1959) Dec. (In German)

The terms in the Hamilton functions which are dependent on the field strength lead in the derivation from variation principle to a mass operator of the Heisenberg type. Their coefficients are adjusted on this basis. (tr-auth)

8055

ENERGY DISTRIBUTION OF ELECTRONS WHICH ARE RELEASED IN THE IRRADIATION OF THIN FOILS BY IONS AND ELECTRONS. W. Dietrich and H. Seiler (Universität, Tubingen, Ger.). Z. Physik 157, 576-85 (1960). (In German)

The energy distribution of electrons, which is released from the back side of thin Ni, Ag, Al, C, and KCl foils by irradiation with lithium ions at 57 kev and electrons at 5 kev, was measured. The energy distribution of the electrons is shown to be material dependent. Moreover, it is broader in the release by electrons than in the release by ions. KCl has the narrowest distribution (half-width of 1.8 ev for ions and 2.7 ev for electrons), and Ni has the broadest (half-width of 3.7 ev for ions and 4.3 ev for electrons). During the irradiation a precipitate is formed on the foils which causes, for long irradiation periods, the energy distribution from KCl to be broader and from Ni to be smaller. The monochromaticizing effect of the aperture screen at the focal point of the immersion objective was shown to be dependent on the screen diameter. The half width of the energy distribution from Ni decreased from 3.7 ev (without screen) to 0.45 ev (30-μ screen). (tr-auth)

8056

COHERENT DIVISION OF AN ELECTRON BEAM BY MAGNETIC FIELDS. E. Krimmel (Universität, Tübingen, Ger.). Z. Physik 158, 35-8(1960). (In German)

An attempt was made to produce an electron beam from as small a source as possible by coherent splitting and overlapping using two small homogeneous antiparallel magnetic fields. This is done by means of the fields of magnetic tape heads which are excited by direct current. The electron interference phenomenon shows that it is effectively a case of three superimposed wave trains. While two particle clusters which are produced by the homogeneous antiparallel magnetic fields come from the virtual source, an intermittent real source arises from the inhomogeneous central region behind the magnetic quadrupole. A light optical analog experiment confirms this. (tr-auth)

8057

ELECTRON MAGNETIC MOMENT AND ATOMIC MAGNETISM. Vernon W. Hughes (Yale Univ., New Haven). p. 65-92 of "Recent Research in Molecular Beams." Immanuel Estermann, ed. New York, Academic Press, 1959. 194p.

Theoretical and experimental values of the electron spin magnetic moment and the atomic electronic magnetic moments (g_j values) were compiled for various isotopes. Diagrams for various apparatuses used in experimental measurements are given. (C.J.G.)

8058

A STERN-GERLACH EXPERIMENT ON POLARIZED NEUTRONS. J. E. Sherwood, T. E. Stephenson, and Seymour Bernstein (Oak Ridge National Lab., Tenn.). p.181-7 of "Recent Research in Molecular Beams." Immanuel Estermann, ed. New York, Academic Press, 1959. 194p.

Experimental studies were made of neutron polarization by a magnetized iron mirror. It was found that the resultant spin in a neutron beam polarized by reflection from magnetized iron is parallel to the magnetic field applied to the mirror. (C.J.G.)

Nuclear Properties and Reactions

8059 AFOSR-TR-59-28

Bartol Research Foundation, Swarthmore, Penna.

DETERMINATION OF NUCLEAR DISINTEGRATION ENERGIES. Final Report for Period November 1, 1954-October 31, 1958. C. E. Mandeville, D. M. Van Patter, W. C. Porter, M. A. Rothman, and C. P. Swann. 18p. Contract AF18(600)-1320. (AD-211322)

A summary is given of a program concerning the precise determination of nuclear disintegration energies using a magnetic spectrometer for charged particles in conjunction with the O.N.R.-Bartol Van de Graaff accelerator. Investigations were made of nuclear reactions caused by the bombardment by 1.5 to 5.0 Mev protons of the following nuclei: Al^{27}, P^{31}, Cl^{35}, Cl^{37}, Cr^{50}, Cr^{52}, Cr^{53}, Cr^{54}, Zn^{64}, Zn^{66}, and Zn^{68}. In several cases, the excitation curves for inelastic proton scattering were observed over a limited range of bombarding energies. Contributions were made with respect to the compilation of nuclear reaction energy data and the comparison of masses obtained from mass spectroscopy and nuclear reaction data. A systematic study of the data available concerning the properties of low-lying levels of even-even nuclei, particularly those in the medium weight range was conducted. This study has revealed new possible trends which are of considerable theoretical interest. (auth)

8060 CU-190

Columbia Univ., New York.

INTERNAL BREMSSTRAHLUNG SPECTRUM ACCOMPANYING 1S ELECTRON CAPTURE IN DECAY OF Fe^{55}, Cs^{131}, AND Tl^{204} (thesis). Marion H. Biavati. May 25, 1959. 57p. Contract AT-30-1-GEN-72. OTS.

The internal bremsstrahlung spectra in coincidence with

the K x rays resulting from 1S electron capture in Fe^{55} and Cs^{131} were measured. The shape of the coincidence spectra exhibits a maximum at the predicted energy and then drops off in intensity toward the low-energy region. This is markedly different from that of the single bremsstrahlung spectrum which rises continuously toward the low-energy region. The agreement between the observed coincidence shape and that predicted by Glauber and Martin for the radiative capture of S electrons is excellent. In the case of Cs^{131}, the shape of the bremsstrahlung spectrum of the radiative capture of P electrons as obtained by subtracting from the total spectrum the spectrum due to S electron capture is also in good accord with that predicted. The experimental arrangement involves thin NaI crystals enclosed in thin Be or aluminum windowed containers and a fast-slow coincidence circuit of resolving time varying from 10^{-8} to 10^{-7} sec. The amount of coincident iodine x rays in the bremsstrahlung detector was estimated by supplementary measurements and was subtracted for the final results. The end point of the 1S electron capture bremsstrahlung spectrum of Tl^{204} was also measured. (auth)

8061 CWLR-2299

Chemical Warfare Labs., Army Chemical Center, Md.
AN EXPERIMENTAL STUDY OF THE INDUCTION OF GAMMA-EMITTING ACTIVITIES IN SEVERAL AMERICAN SOILS BY NEUTRONS OF VARIOUS ENERGIES. [Period covered:] November 15, 1956–December 15, 1956. John H. McNeilly and Eugene Eichler. Dec. 3, 1958. 27p.

Experiments are described which were conducted to determine the important gamma-emitting nuclides which are formed in soils by neutrons of various energies. It was found that the radiative capture of thermal neutrons was the predominant reaction and the important nuclides formed are Al^{28}, Mn^{56}, and Na^{24}. (auth)

8062 KAPL-M-ECH-2

Knolls Atomic Power Lab., Schenectady, N. Y.
LONG TERM IRRADIATION OF NATURAL DYSPROSIUM. E. C. Hansen. Dec. 28, 1959. 22p. Contract W-31-109-Eng-52. OTS.

The isotopic population of natural dysprosium and its irradiation products is presented for times of $0 \leq t \leq 50{,}000$ hrs, thermal fluxes of $10^{12} \leq \phi \leq 10^{14}$, and epi-thermal to thermal flux ratios of $0 \leq A \leq 8$. The isotopic population is equivalent to fuel depletions of zero to 99% depending upon the thermal flux level. The major limitation to the presented results is the assumption of infinite dilution, i.e., no spatial or energy self shielding, therefore being applicable to the case of a distributed poison. The error in the presented results is ~ ±20%. (auth)

8063 NP-8313

Catania, Italy. Università. Istituto di Fisica and Italy. Centro Siciliano di Fisica Nucleare, Catania.
TOTAL NEUTRON CROSS SECTION FOR PHOSPHORUS AND CROSS SECTION FOR THE $^{31}P(n,p)^{31}Si$ REACTION WITH NEUTRON ENERGY FROM 3 TO 5 Mev. Technical Final Report. [1960]. 24p. Contract AF61(052)-37.

The neutron total cross section of P^{31} and the cross section for the reaction $P^{31}(n,p)Si^{31}$ were measured for neutron energies of 3 to 5 Mev. Neutrons from the reaction of deuterons on a D_2O target were used. Resonance peaks were found at 3.17, 4.47, and 4.74 Mev for the (n,p) reactions. (W.D.M.)

8064 UCRL-8931

California. Univ., Berkeley. Lawrence Radiation Lab.
THEORY OF α-DECAY. Hans J. Mang. Oct. 1959. 73p. Contract W-7405-eng-48. OTS.

A theory of alpha decay was developed whose aim was to take into account the influence of nuclear structure. The theory was found to be successful in explaining the fine structure of the Po^{211} α decay. A brief outline is presented of the derivation of the formulas which are applied to discuss the ground state transitions of even-even and odd-even nuclei in the region around Pb^{208} and the fine structure of some α decays in this region. The nuclear wave functions are approximated by shell model wave functions, and good agreement is obtained with experimental data. The formulas are given that are necessary to treat α decays of deformed nuclei on the basis of the unified model. (W.L.H.)

8065 UCRL-8965

California. Univ., Berkeley. Lawrence Radiation Lab.
THE ELASTIC SCATTERING OF 5-Bev π^- MESONS ON HYDROGEN (thesis). Richard Garland Thomas, Jr. Nov. 3, 1959. 63p. Contract W-7405-eng-48. OTS.

The results of the elastic scattering of 5-Bev negative pions on hydrogen are reported in detail. A description of the propane bubble chamber is given. Two different methods of identification of events are described, and the errors that limit the accuracy of each are considered. Particular attention is directed to the problem of background events. It is shown that ~ 7 (±3)% of the events called elastic are background. The data are analyzed in terms of the optical model because the angular distribution shows the sharp rise in the forward direction characteristic of diffraction scattering. The modified least-squares procedure used to fit the data is outlined. From the least-squares representation of the best-fitting curve, it is found that $d\sigma(0)/d\omega$ = 29.8 mb/sterad in the center-of-mass system, and the pion radius of the proton is $1.04 \pm 0.05 \times 10^{-13}$ cm. The total elastic cross section is 5.6 ± 0.5 mb. The results are compared with those derived from theory and other experiments. It is shown that the assumption that the proton acts like a black sphere leads to an elastic cross section much higher than observed. From the above value of the differential cross section in the forward direction, the total hydrogen cross section is found to be 29.1 ± 2.9 mb. This leads to a value for the opacity of the sphere of 0.69 ± 0.05. (auth)

8066 WADC-TN-59-107

Texas Nuclear Corp., Austin, Tex.
NEUTRON INTERACTIONS IN LITHIUM, CARBON, NITROGEN, ALUMINUM, ARGON, MANGANESE, YTTRIUM, ZIRCONIUM, RADIOLEAD, AND BISMUTH. [Period covered] March 15, 1958 to March 14, 1959. Norman A. Bostrom, Ira L. Morgan, J. Thomas Prud'homme, Pablo L. Okhuysen, and O. M. Hudson, Jr. Feb. 1959. 148p. Project No. 2134. Contract AF33(616)-5619. OTS.

An investigation of the interaction of neutrons in Li, C, N, Al, Ar, Mn, Y, Zr, Bi, and Pb was made for various neutron energies. Angular and energy distributions, gamma spectra, and cross sections were measured at neutron energies from 100 kev to 17 Mev. (W.D.M.)

8067 AEC-tr-3965

SEVERAL POSSIBILITIES OF USING POLARIZED THERMAL NEUTRONS CONNECTED WITH NONCONSERVATION OF PARITY DURING β-DECAY. F. L. Shapiro. Translated by Lydia Venters (Argonne National Lab.) from Uspekhi Fiz. Nauk 65, 133-40(1958). 10p. JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 14183.

8068 AEC-tr-3966

THE AVERAGE NUMBER OF PROMPT NEUTRONS $\bar{\nu}$ EMITTED DURING PHOTOFISSION OF Th^{232} AND U^{238} BY γ-RAYS FROM THE REACTION $F^{19}(p,\alpha\gamma)O^{16}$. L. I.

Prokhorova and G. N. Smirenkin. Translated from a Russian report presented by the mission of scientists during their visit to Oak Ridge National Lab., in November 1959. 11p. (Includes original, 6p.). JCL or LC.

The average number of neutrons emitted during photofission of U^{238} and Th^{232} by γ rays from the $F^{19}(p,\alpha\gamma)$ reaction was measured. The reaction was carried out by bombarding a CaF_2 crystal with 2.6-Mev protons. The average energy of the γ rays producing the U^{238} and Th^{232} fissions was approximately 6.7 Mev. Values of 4.15 ± 0.3 and 3.05 ± 0.25 were found for U and Th. (W.D.M.)

8069 UCRL-Trans-103

ON THE CORRELATION BETWEEN THE DISCONTINUITIES IN THE MASS VALLEY AND NUCLEAR ENVELOPES. APPLICATION TO THE STUDY OF THE ALPHA SYSTEMATICS. A. Broniewski. Translated by Bonnie E. Cushman (Univ. of California Radiation Lab.) from Can. J. Phys. 29, 193-202(1951). 17p. JCL.

It is shown that discontinuities produced in the regular variation of the mass valley in the function of A are connected roughly in the first part of the periodic table to the phenomenon of saturation of the proton shells and in the second part, to the saturation of the neutron envelopes, the order of succession of which was established. The hypothesis of the existence of a discontinuity in the region of the transuranium elements is discussed. Such a discontinuity has as a consequence the modification of the actual predictions made on the alpha energies of the transuranium elements. (auth)

8070 UCRL-Trans-117

ON THE β^+ EMISSION-K CAPTURE BRANCHING RATIO: CASE OF ALLOWED TRANSITION (II). R. Bouchez, S. R. de Groot, R. Nataf, and H. A. Tolhoek. Translated by Bonnie E. Cushman (Univ. of California Radiation Lab.) from J. phys. radium 11, 105-19(1950). 27p. JCL.

The branching ratio relating to the nuclei Cu^{61} and Cu^{64} which disintegrate by K capture and by the emission of positrons was experimentally determined. The experimental results are compared with the theory of β disintegration, and in the case of Cu^{61} a disagreement was found. A re-examination was made of the relations between the probability of K capture and the emission of positrons and in particular the relations relating to the different elements of the nuclear matrix and the angular momenta of the levels. (W.L.H.)

8071 UCRL-Trans-121

ENERGY LEVELS OF Mn^{56} AND V^{52}. A. Ya. Abramov. Translated by Bonnie E. Cushman (Univ. of California Radiation Lab.) from Doklady Akad. Nauk S.S.S.R. 73, 921-4 (1950). 8p. JCL or LC.

The energy distribution of protons resulting from the bombardment of Mn and V targets by 3.8 ± 0.1 Mev deuterons was studied. (W.L.H.)

8072

THRESHOLD EFFECTS IN NUCLEAR REACTIONS. A. I. Baz (Atomic Energy Inst., Moscow). Advances in Phys. 8, 349-74(1959) Oct.

We explore the idea that between the colliding particles or the reaction products of a nuclear reaction the interaction in the immediate neighborhood of the nuclear surface may be represented by a static attractive potential. The Wigner-Eisenbud theory of nuclear reactions is readily reformulated to take this "surface potential" into account, whereupon quasi-bound states of the compound system are found to appear, with high probability, very close to the various thresholds for two-particle channels. Consequently, the cross section of a reaction close to any threshold should have a certain resonance-like behavior. The relevant experimental data are reviewed and are found to support all the predictions of the theory. (auth)

8073

TYPE M1 TRANSITIONS FROM HIGHLY EXCITED STATES. L. V. Groshev and A. M. Demidov. Atomnaya Energ. 7, 321-8(1959) Oct. (In Russian)

Probabilities of M1 transitions from thermal neutron capture states in even–odd and odd–odd nuclei with A from 20 to 60 are investigated. In single-particle models such transitions are l forbidden. The comparison with E1 transition probabilities shows that in even–odd nuclei the forbidden M1 transition probabilities do not differ greatly from the probabilities of l permitted M1 transitions in lighter nuclei. For odd–odd nuclei some M1 transitions are expressed by the large number of quanta per neutron capture. (tr-auth)

8074

THE ALBEDO PRESENTED BY VARIOUS SUBSTANCES TO γ-RAYS FROM ISOTROPIC SOURCES OF Co^{60}, Cs^{137} and Cr^{51}. B. P. Bulatov. Atomnaya Energ. 7, 369-72 (1959) Oct. (In Russian)

The albedo of γ rays emitted by a source in direct contact with the surface of a diffuser is investigated. (R.V.J.)

8075

DISTRIBUTION OF THE KINETIC ENERGY AMONG THE FRAGMENTS IN THE THERMAL-NEUTRON-INDUCED TERNARY FISSION OF U^{235}. V. I. Mostovĭ, T. A. Mostovaya, M. Sovinskiĭ, and Yu. S. Saltykov. Atomnaya Energ. 7, 372-4(1959) Oct. (In Russian)

Precise data are developed on kinetic energy distribution among fragments of ternary fission. An ionization chamber equipped with a filter and designed for separately recording of fission fragments and long-range α particles was used. Some 17644 ternary fissions were recorded, and the fragment energy distributions were plotted with consideration for recording probabilities. The probable energies of the heavy and light fragments are 5.7 ± 0.5 and 8.1 ± 0.3 Mev, smaller than for the binary fission. The 13.8-Mev drop in kinetic energy cannot be assigned to the reduced charge of fragments due to α particle emission. The appearance of fragment pairs with masses of 98 to 134, 96 to 136, and 100 to 132 are considered as probable as the appearance of masses 100 and 136 in binary fission. With the above assumptions the mean energy of fragment excitation in ternary fission should be 5.87 Mev smaller than in binary. The half-width distribution of light and heavy fragments in ternary fission is 1.1 ± 0.5 and 4.3 ± 1.0 Mev less than the respective half-widths in binary fission. The kinetic energy distribution of ternary fission fragments is both displaced and different in shape. (R.V.J.)

8076

THE MEAN NUMBER OF NEUTRONS EMITTED IN TERNARY FISSION BY U^{235}. V. F. Apalin, Yu. P. Dobrynin, V. P. Zakharova, I. E. Kutikov, and L. A. Mikaelyan. Atomnaya Energ. 7, 375-6(1959) Oct. (In Russian)

The mean number of neutrons ν emitted in intermediate U^{235} ternary fission was measured. The mean value of ν at $E > 22$ Mev was 1.76 ± 0.13, in good agreement with published data. The data indicate that the fragment excitation energy does not depend on the energy of long-range α particles. (R.V.J.)

8077

THE INTERACTION BETWEEN FAST NUCLEONS AND NUCLEI OF NIKFI-R PHOTO EMULSION. V. S. Barashen-

kov, V. A. Belyakov, Wan Shu-Feng, V. V. Glagolev, N. Dolkhazhav, L. F. Kirillova, R. M. Lebedev, V. M. Maltsev, P. K. Markov, K. D. Tolstov, E. N. Tsyganov, M. G. Shafranova, and Yao Ching-Hseih. Atomnaya Energ. 7, 376-7(1959) Oct. (In Russian)

Interactions of 9-Bev protons, accelerated in the synchrophasotron, with NIKFI-R photoemulsion nuclei were studied. The mean number of charged particles calculated for one star, the kinetic energy of pions and protons, and the mean cross section of s protons and g protons are tabulated and analyzed. (R.V.J.)

8078

EXCITATION CURVES FOR THE REACTION $B^{11}(d,2n)C^{11}$, $Be^{9}(\alpha,2n)C^{11}$, $B^{10}(d,n)C^{11}$ AND $C^{12}(d,n)N^{13}$. O. D. Brill and L. V. Sumin. Atomnaya Energ. 7, 377-9(1959) Oct. (In Russian)

Excitation curves at initial deuteron energies of 19.0 ± 0.2 Mev and α particle energies of 38.5 ± 0.4 Mev were measured by the stack method. Foil stacks were prepared from a boron and polystyrene mixture and irradiated by a cyclotron beam. Foils of 5 to 10 mg/cm^2 thickness with 20 to 30% boron and beryllium foils of 2 to 4 mg/cm^2 thickness prepared by electrolysis of BeF_2 and NaF melts were used. The bombarding particle energy was determined by track-energy curves derived by extrapolating known curves for paraffin, air, and aluminum. The Q value for $B^{11}(d,2n)C^{11}$ was −5.0 Mev; for $B^{10}(d,n)C^{11}$ it was +6.5 Mev; for $C^{12}(d,t)C^{11}$ it was −12.5 Mev; and for $C^{12}(d,n)N^{13}$ it was −0.28 Mev. (R.V.J.)

8079

SPALLATION OF HAFNIUM BY 660 Mev PROTONS. A. K. Lavrukhina and A. A. Pozdnyakov. Atomnaya Energ. 7, 382-4(1959) Oct. (In Russian)

The yield of spallation products and the process of 660-Mev proton interactions with hafnium nuclei are investigated. Yields of spallation products and β^-, β^+, and K-capture isotopes were determined. For the K-capture isotopes the order of precision was 50 to 100%. The yield of isotopes as a function of their mass number was plotted. The spallation shows a cupola-shaped curve similar to that of copper spallation; however, the hafnium cupola is shifted toward neutron-deficient nuclei. Tabulated results show that the mean number of evaporated neutrons in hafnium spallation is 3.7 fold higher than the mean number of neutrons evaporated from copper, while the number of evaporated protons is only 1.6 fold greater. A sharp increase in the number of evaporated neutrons is indicated for atomic numbers from 29 to 79, while the number of cascade neutrons remains stable (2 for copper and 2.5 for hafnium). The mean excitation energy for hafnium nuclei, found at 150 Mev, is in good agreement with published data. (R.V.J.)

8080

HALF-LIVES OF THE NUCLIDES Au^{195}, Pt^{195m}, AND Pt^{197} M. Bresesti and J. C. Roy (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Chem. 38, 194-8(1960) Feb.

The half-lives of Au^{195}, Pt^{195m}, and Pt^{197} were measured. The radionuclides were produced by neutron irradiation in the NRX reactor and were radiochemically purified after the irradiation. The decay of the x rays and γ-radiations from Au^{195} and Pt^{195m} was observed with a NaI (Tl) detector, and the β-decay of Pt^{197} was observed with an anthracene detector. The half-lives are: Au^{195}, 199 ± 3 days, Pt^{195m}, 4.08 ± 0.12 days; and Pt^{197}, 20.00 ± 0.12 hours. The errors quoted are the estimated reliability of the measurement and include the statistical counting error plus an estimated systematic error. (auth)

8081

CROSS SECTIONS OF ASTATINE ISOTOPES 206 TO 211 PRODUCED BY SECONDARY (α,xn) REACTIONS DURING BOMBARDMENT OF BISMUTH BY PROTONS AT 150 Mev. Marc Lefort, Gabriel Simonoff, and Xavier Tarrago (Faculté des Sciences, Orsay, France). Compt. rend. 250, 106-8(1960) Jan. 4. (In French)

A radiochemical study was made of the different At isotopes produced by Bi bombardment by 150-Mev protons. According to the cross sections measured, which correspond to the secondary (α,xn) reactions, it was calculated that the formation cross section of α particles of more than 20 Mev was 70 mb. (tr-auth)

8082

DETERMINATION OF THE NUCLEAR MAGNETIC MOMENT OF Hg^{199} from the HYPERFINE STRUCTURE OF THE 5641 A LINE OF HgI. Ion I. Agarbiceanu, Nicolas Ionesco Pallas, Vasile Drăganesco, Nicolas Comaniciu, and Vasile Tatu (Institut de Physique Atomique, Bucharest). Compt. rend. 250, 317-18(1960) Jan. 11. (In French)

A redetermination was made of the nuclear magnetic moment of Hg^{199} using several photographic chambers with different focal lengths, and an interferometer with a reflection factor of 0.9 and a 3-mm thickness in the spectral region studied. These modifications were intended to eliminate specific errors found in a previous determination. A value of μ_{199} = +0.504 nuclear magnetons is reported. (T.R.H.)

8083

RESONANT ABSORPTION WITHOUT RECOIL OF 23.8 kev γ RADIATION OF Sn^{119}. Roland Barloutaud, Eugène Cotton, Jean-Loup Picou, and Jacques Quidort (Centre d'Études Nucléaires, Saclay, France). Compt. rend. 250, 319-21(1959). (In French)

Absorption experiments were conducted at several temperatures to show the effect on the 23.8-kev radiation of Sn^{119}. The proportion of photons emitted without recoil of the nucleus would be, in the absence of quadrupolar division, 0.285 ± 0.015 at 77°K and 0.045 ± 0.01 at 300°K. The displacement of the screen at 77°K does not permit elimination of this division. (tr-auth)

8084

THE POSSIBILITY OF SHOWING THE PHASE COHERENCE IN RESONANCE SCATTERING OF γ RAYS BY ATOMIC NUCLEI. Alfred Kastler (École Normale Supérieure, Paris). Compt. rend. 250, 509-11(1960) Jan. 18. (In French)

When γ resonance scattering by the atomic nuclei of a lattice takes place without recoil, the scattered radiation should be evident from an intensity distribution analogous to that of x-ray diffraction by the electrons of a crystal. (tr-auth)

8085

RADIATIVE CAPTURE OF SLOW NEUTRONS ON ATOMIC NUCLEI. Jan Urbanec, Jiří Kopecký, and Josef Kajfosz. Czechoslov. J. Phys. 9, 544-51(1959). (In Russian)

The energies and absolute intensities of gamma radiation from the radiative capture of thermal neutrons on S^{33}, Cl^{36}, K^{40}, Ca^{41}, V^{52}, Mn^{56}, and Hg^{200} nuclei were measured by means of a single-crystal scintillation spectrometer. The transitions measured in the energy interval 100 to 1200 kev are mostly transitions between the lowest excited states of the nuclei studied. (auth)

8086

NUCLEAR MAGNETIC RESONANCE OF F^{19} IN TEFLON IRRADIATED WITH NEUTRONS. Jiří Burget and Jiří

Šácha (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 749-50 (1959). (In English)

The nuclear magnetic resonance of F^{19} nuclei in a Teflon sample irradiated with neutrons was observed and compared with the resonance of an unirradiated sample. The sample was irradiated for five hours at 10^{12}n/cm^2/sec. The resultant widening of the absorption curve was due possibly to: (a) formation of double bonds (or the formation of rings) as a result of the broken C–C bond; (b) the formation of double bonds and cross-linkage as a result of the broken C–F bond. (B.O.G.)

8087

FIELD GRADIENTS AT THE DEUTERON IN MOLECULES. R. Bersohn (Columbia Univ., New York). J. Chem. Phys. 32, 85-8(1960) Jan.

A survey of the observed quadrupole coupling constants of the deuteron is presented. It is concluded on the basis of calculations that the field gradients at hydrogen nuclei will be positive in almost all molecules. The simple wave functions greatly underestimate the field gradients of the bonding electrons. A good part, but not all, of the discrepancy, previously noted by White, can be removed with the use of a contracted charge distribution and ionic character. The wave function of Ellison and Shull gives a very bad description of the field gradients at the deuterons in D_2O but the experimental data indicate the direction for future improvement. The field gradients at deuterons remain attractive quantities for characterizing the charge density in bonds involving hydrogen atoms. (auth)

8088

DIPOLE MOMENT OF HD. S. M. Blinder (Harvard Univ., Cambridge, Mass.). J. Chem. Phys. 32, 105-10(1960) Jan.

The HD molecule has a small permanent electric dipole moment as a consequence of the asymmetry of nuclear vibration. The complete molecular Hamiltonian contains a term which is not invariant to inversion of electronic coordinates through the molecular center. This gives rise to an axial asymmetry of electronic charge. Treating the term as a perturbation, it is found that the $^1\Sigma_g^+$ electronic ground state is perturbed only by states of $^1\Sigma_u^+$ symmetry. Assuming that only the lowest such state (the B state) contributes, an upper bound on the permanent moment is established. For the ground vibrational state this is computed to be 8.89×10^{-4} Debye unit, directed in the sense H^+D^- (auth)

8089

LIFETIME OF THE FIRST EXCITED STATE OF Mg^{25} AND THE COLLECTIVE MODEL. G. R. Bishop and P. Kossanyi-Demay (Université, Paris). J. phys. radium 20, 921-6(1959) Dec. (In French)

The lifetime of the first excited state of Mg^{25} was determined by measuring the distance that the recoiling nucleus travels from the reaction $Mg^{25}(p, p')Mg^{25*}$. The lifetime was found to be in the range $(2 < \tau < 4) \times 10^{-9}$ secs. This is compared with the predictions of the collective model, using wave functions obtained by a modification of Nilsson's calculations for the d-shell. (auth)

8090

PRODUCTION OF TRITIUM IN THORIUM BY PROTONS AT 135 Mev. M. Lefort, G. Simonoff, and X. Tarrago (Laboratoire de Physique Nucléaire, Orsay, France) and R. Bibron (Centre d'Études Nucléaires, Saclay). J. Phys. radium 20, 959-62(1959) Dec. (In French)

The cross-section of tritium production was measured by bombardment of thorium by 135 Mev protons in the Orsay synchrocyclotron. The tritium was separated from the targets by heating in a graphite crucible with a high-frequency generator, under hydrogen gas pressure. Tritiated water was synthetized and the tritium was measured with liquid scintillator. A value of 19.5 ± 0.05 mbarns was obtained for the tritium cross section and ten percent of tritons have energies higher than 35 Mev. This large cross section is attributed to a double pick-up process. (auth)

8091

RADIATIONS FROM Ba^{141}. Kunio Nagatani (Tohoku Univ., Sendai). J. Phys. Soc. Japan 15, 1-2(1960) Jan.

Beta- and gamma-rays from 18-min Ba^{141} were investigated using scintillation spectrometers. Ba^{141} was made from photofission of natural uranium. The end-point energy of the beta-ray was determined to be 2.8-Mev and the gamma-rays of energies 0.125, 0.19, 0.28, 0.37, 0.46, and 0.61-Mev, respectively, were observed. (auth)

8092

ANGULAR CORRELATION MEASUREMENTS IN THE DECAY OF In^{114m} Mitsuhiro Kawamura (Kyoto Univ.). J. Phys. Soc. Japan 15, 3-8(1960) Jan.

The directional correlation and the polarization-direction correlation of the 722 to 556 kev gamma-gamma cascade in Cd^{114} were measured. It is found that the decay sequence of this cascade agrees well with the 4(E2)2-(E2)0 sequence. The ratio of the rate of the positron decay to that of the cascade decay is also obtained as 3×10^{-3}. (auth)

8093

INVESTIGATION OF THE REACTION $Mg^{25}(p,\gamma)Al^{26}$. Jiro Muto (Kyoto Univ.). J. Phys. Soc. Japan 15, 17-27(1960) Jan.

The $Mg^{25}(p,\gamma)Al^{26}$ reaction was studied at the three resonances of 317, 392, and 437-kev proton energy. The level of Al^{26}, corresponding to the third excited state (3.97 Mev) in Mg^{26}, was found at 4.18 ± 0.02 Mev. Through the angular distributions of γ-rays, spins and parities of this level and some other levels were assigned as follows: 3.16 Mev, $J = 2^+$; 4.18 Mev, $J = 3^+$; 6.61 Mev, $J = 3^-$; 6.68 Mev, $J = 2^+$ or 3^+; 6.72 Mev, $J = 4^+$ or 4^-. The second and third excited states in Mg^{26} were estimated to be $J = 2^+$ and $J = 3^+$ respectively. Excitation energies, the gamma decay scheme, and the radiation yield of the resonance levels are also given. The correspondence between levels of Mg^{26} and Al^{26} is discussed and a possible excited state configuration of Mg^{26} is suggested. (auth)

8094

GAMMA-RAYS FROM THE REACTION $Al^{27}(p,\gamma)Si^{28}$. Kotoyuki Okano (Kyoto Univ.). J. Phys. Soc. Japan 15, 28-41(1960) Jan.

Gamma-rays from the reaction $Al^{27}(p,\gamma)Si^{28}$ were studied at the four resonances occurring at $E_p = 226$, 294, 326, and 405 kev by the use of a large NaI crystal scintillation spectrometer. The gamma-ray transitions from the resonance states to the levels in Si^{28} at 1.78 Mev (1st), 4.62 Mev (2nd), 6.91 Mev, and 8.58 Mev were observed. Spins and parities of these levels and some of the resonance levels are deduced from the anisotropies of gamma rays as follows: 4.62 Mev, $J = 4^{(+)}$; 6.91 Mev, $J = 2^+$ or 4^+; 8.58 Mev, $J = 3^+$; 11.90 Mev, $J = 4^{(-)}$; 11.98 Mev, $J = 4^-$. $J = 4^{(+)}$ for the second excited state suggests the collective nature of this excited v level which was expected from the other evidences found in neighboring nuclei. The gamma-ray yield and the branching ratios of each resonance level are also given. (auth)

8095

Ir^{194m}; A NEW NUCLEAR ISOMER WITH 47-SEC HALF-LIFE. Hans-Henning Hennies and Arnold Flammersfeld (Universität, Göttingen, Ger.). Naturwissenschaften 47, 11-12(1960) Jan. (In German)

Spectroscopically pure Ir powder was irradiated with slow neutrons from deuteron bombardment of Be^9 at 1 Mev for 10 sec to 1 min. The β spectrum was measured with a plastic scintillator and, after irradiation, was photographed by a pulse spectrograph. Along with the short-lived β component the 19-hr Ir^{194} decay to Pt^{194} was observed. The new activity was assigned to Pt^{194m} It is certain that the 130-kev gamma line is the unconverted isomer process to Ir^{194} since this γ quantum doesn't coincide with the β particle. (T.R.H.)

8096

TRANSVERSE POLARIZATION OF K-CONVERSION ELECTRONS FOLLOWING THE BETA DECAY OF Hg^{203}. J. E. Alberghini and R. M. Steffen (Purdue Univ., Lafayette, Ind.). Nuclear Phys. 14, 199-204(1959) Dec. (2).

The degree of transverse polarization of the K-conversion electrons following the first-forbidden beta decay of Hg^{203} was measured. The electron polarization was observed by means of the left-right asymmetry in a Mott-scattering process. The degree of polarization of the conversion electrons was determined as $P_\perp(\theta) = (0.35 \pm 0.07)(v/c) \sin\theta$, where θ is the angle between the beta particle direction and the conversion electron direction. The analysis of the result within the framework of the ξ-approximation for non-unique first-forbidden beta decay gives strong support to the decay scheme $(^3/_2)\ \beta\ (^3/_2)$ c.e. $(^1/_2)$. (auth)

8097

THE USE OF DIGITAL RECORDING OF MAGNETIC TAPE FOR THE STUDY OF γ-RAYS FROM RESONANT NEUTRON CAPTURE IN PLATINUM. J. R. Bird and J. R. Waters (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 14, 212-21(1959) Dec. (2).

The high energy γ-ray spectra resulting from resonant neutron capture in platinum were investigated for neutron energies up to 600 ev. A total of 63 channels of γ-ray energy and 256 of neutron time of flight were recorded simultaneously as binary numbers on magnetic tape giving a total of 16,000 combinations. These define the γ-ray spectra for the resonances and the background between them. The 47, 68.5, and 98 ev resonances give spectra for neutron capture in Pt^{192}, Pt^{196}, and Pt^{198}. These show dominant transitions which can be explained in terms of the shell model. Typical spectra for higher energy resonances are shown. It was found that the intensity of the ground state transition for capture in Pt^{196} showed large fluctuations from resonance to resonance. (auth)

8098

LIFETIME OF THE 3.56-Mev STATE OF Li^6. Leslie Cohen and Ralph A. Tobin (U. S. Naval Research Lab., Washington, D. C.). Nuclear Phys. 14, 243-7(1959) Dec. (2).

The bremsstrahlung beam from a 25-Mev betatron was used to excite the 3.56-Mev state in Li^6. The gamma radiation resulting from the de-excitation of these nuclei was observed with and without a Li^6 absorber inserted in the primary beam. Assuming a spin assignment J = 0 for the excited state, and using a calculated Doppler width of 11.3 ev for enriched lithium metal, an analysis of the data yields a mean lifetime of $(7.2) \times 10^{-17}$ sec. (auth)

8099

ISOTOPE SHIFT FROM NON-UNIFORM NUCLEAR CHARGE DISTRIBUTIONS. A. S. Meligy (Univ. of Alexandria, Egypt). Nuclear Phys. 14, 248-55(1959) Dec. (2).

The isotope shift is derived by solving Dirac's equations for an electron in the static field of a nuclear charge distribution of trapezoidal shape. The values of the parameters identifying this distribution are obtained from the analysis of the electron-nucleus scattering experiments. The magnitude of the derived isotope shift is found to be very nearly half the value previously predicted by a uniformly charged nucleus with radius $1.5 \times 10^{-13} A^{1/3}$ cm. Remarkable agreement was achieved between the isotope shift predicted by the theory and experimental results. (auth)

8100

QUADRUPOLE ENHANCEMENT IN O^{17} AND F^{17}. G. Barton, D. M. Brink, and L. M. Delves (Clarendon Lab., Oxford). Nuclear Phys. 14, 256-62(1959) Dec. (2).

A previous calculation of E2 enhancement was improved by refining the single-particle functions and using Brillouin-Wigner in place of Rayleigh-Schroedinger perturbation theory. The higher order correlations thus introduced enable one to bring the theory into agreement with the data on both O^{17} and F^{17}. Some considerations on the extension of the theory to heavier nuclei are presented. (auth)

8101

THE DISINTEGRATION OF Ne^{20} BY FAST NEUTRONS. R. J. Bell, T. W. Bonner, and F. Gabbard (Rice Inst., Houston, Tex.). Nuclear Phys. 14, 270-6(1959) Dec. (2).

The cross section for the $Ne^{20}(n,\alpha)O^{17}$ reaction was measured for neutron energies between 2.8 and 7.3 Mev. The (n,α) disintegrations were detected in a grid-type ionization chamber filled with neon. The cross section for this reaction varies between 10 and 270 mb in this energy range and shows many narrow resonances. Disintegrations were observed leaving O^{17} in the ground state and in the first three excited states. (auth)

8102

THE DISINTEGRATION OF NITROGEN BY FAST NEUTRONS. Fletcher Gabbard, H. Bichsel, and T. W. Bonner (Rice Inst., Houston, Tex.). Nuclear Phys. 14, 277-94 (1959) Dec. (2).

The disintegration of nitrogen by fast neutrons was studied using a grid-type ionization chamber filled with nitrogen or a nitrogen-argon mixture. Monoenergetic neutrons for studying the reactions from a neutron energy of 1.3 to 8.2 Mev were produced by the $T^3(p,n)He^3$ and $D(d,n)He^3$ reactions. One group of protons, three alpha particle groups, and a group of tritons were observed as disintegration products of the neutron reactions in nitrogen. The $N^{14}(n,p)C^{14}$ reaction leaving C^{14} in its ground state was studied from 1.3 to 4.3 Mev and the maximum cross section observed was 230 mb. Four groups of α-particles leading to the ground, 2.14, 4.46, and 5.03 Mev levels in B^{11} were observed in the experiment. The cross section for the α-particle group leading to the ground state of B^{11} varied from 5 mb at a neutron energy of 1.3 Mev to 390 mb at 4.2 Mev and decreased for higher neutron energies. Triton emission leading to the ground state of C^{12} was observed above a neutron energy of 5.6 Mev. Above 7 Mev, the cross sections for disintegration by emission of each of the alpha groups and by triton emission were about equal and were approximately 40 mb. The cross sections show many narrow resonances in the neutron energy range studied. The data show that alpha emission relative to proton and neutron emission from these highly excited states of N^{15} is much more probable than expected on shell model considerations. (auth)

8103

GAMMA RADIATIONS FROM INELASTIC SCATTERING OF FAST NEUTRONS IN C^{12}, N^{14}, AND O^{16}. H. E. Hall and T. W. Bonner (Rice Inst., Houston, Tex.). Nuclear Phys. 14, 295-313(1959) Dec. (2).

Measurements were made of the cross section for the production of 4.43-Mev γ-radiation by the inelastic scattering of neutrons by C^{12}. The experiments were carried out using monoenergetic neutrons with energies from 4.6 to 9.8 Mev. Ten resonances were observed in this energy range and the maximum cross section of 45 mb/sterad was obtained at a neutron-energy of 8.1 Mev. Measurements made with an O^{16} scatterer also showed many resonances for the production of γ-radiation with energies of 6.14, 6.91, and 7.12 Mev. The maximum cross section for γ-emission was obtained with 9.1-Mev neutrons and amounted to 30 mb/sterad. Population of the 6.06-Mev pair emitting state in O^{16} was not observed and an upper limit on the probability of exciting this state was less than 10% of that for the excitation of the γ emitting states. Gamma radiations from the interaction of fast neutrons in N^{14} were observed with neutrons of energies from 4.7 to 8.1 Mev. Gamma radiations with energies of 1.64, 2.14, 2.31, 4.46, and 5.06 Mev were observed. Approximately half of the cross section for the production of γ-radiation is from the $N^{14}(n,\alpha)B^{11*}$ reaction and the rest is from inelastic scattering in N^{14}. At a neutron energy of 7.3 Mev the cross section for the $N^{14}(n,n'\gamma)N^{14}$ reaction, including cascades, is 16.2 mb/sterad and the cross section of the $N^{14}(n,\alpha)B^{11*}$ reaction leading to the first three excited states is 10.7 mb/sterad. (auth)

8104

THE SLOWING DOWN OF NEUTRONS BY DEUTERIUM. M. M. Levine, K. E. Roach, and D. B. Wehmeyer (Babcock & Wilcox Co., Lynchburg, Va.) and P. F. Zweifel (Univ. of Michigan, Ann Arbor). Nuclear Sci. and Eng. 7, 14-20 (1960) Jan.

The Greuling-Goertzel method is applied to calculation of the slowing down of neutrons in deuterium, and the results compared with the Selengut-Goertzel method, in which the deuterium slowing-down is treated by age theory. It is shown how existing codes for calculating slowing down in hydrogen can be modified in a simple manner to incorporate this treatment of deuterium. Numerical results show excellent agreement between measured and calculated ages, and indicate that a continuous slowing-down model for deuterium is inappropriate. This is in qualitative agreement with the experiments performed by Wade, and in disagreement with Olcott's work. It is shown that an age kernel with an age to indium of 100 cm^2 may be used to compute the fast leakage from heavy-water systems over a wide range of buckling. The situation concerning agreement with critical experiments remains to be clarified because of large uncertainties in other criticality factors. (auth)

8105

THE ELASTIC AND INELASTIC SCATTERING OF 6 AND 7 MEV γ-RAYS FROM LEAD. S. G. Cohen (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuovo cimento (10) 14, 931-7(1959) Dec. 1. (In English)

The 6- and 7-Mev γ rays produced in the $F^{19}(p,\alpha)O^{16}$ reaction at proton energies of 1.5 and 2.9 Mev, respectively, were scattered from lead. The spectrum of scattered γ rays was measured at a mean scattering angle of 30°, using a sodium iodide scintillator. Elastic scattering was observed, particularly for 7 Mev γ rays for which the average differential cross section at the latter energy is about 5.10^{-28} cm^2/sterad. This elastic scattering was probably associated with resonance absorption of the Doppler broadened primary γ rays. Inelastic scattering of γ rays leading to excited states of lead nuclei was observed. (auth)

8106

ON THE INTERPRETATION OF THE K^--MESON INTERACTION IN NUCLEAR EMULSION. U. Kundt, K. Lanius, and K. Lewin (Deutsche Akademie der Wissenschaften, Berlin). Nuovo cimento (10) 14, 943-50(1959) Dec. 1. (In English)

Observed frequencies of pions emitted by K^- captures at rest in nuclear emulsion were used for an estimation of the percentage of 1π interactions. It is shown that 20% is an upper limit for the percentage of 2π interactions and that the capture must occur preferentially at the nuclear surface. Branching ratios for the production of different kinds of hyperons in the 1π interactions was determined. (auth)

8107

STUDY OF ANTIPROTONS WITH EMULSION TECHNIQUE. E. Amaldi, G. Baroni, G. Bellettini, C. Castagnoli, M. Ferro-Luzzi, and A. Manfredini (Università, Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 14, 977-1026(1959) Dec. 1. (In English)

The cross-sections for antiproton interactions in nuclear emulsions at 10 to 230 Mev ($\overline{T}_{\overline{p}}$ = 150 Mev), are given for the processes: inelastic scattering, elastic scattering, and annihilation + charge exchange. The statistics give the cross-section for annihilation + charge exchange as a function of the kinetic energy of the incident $\overline{p}$. The annihilation process was studied in detail for antiprotons annihilating in flight as well as at rest. The multiplicity and the spectrum of the $\pi^{\pm}$, and the number of pions interacting inside the emulsion nucleus where the annihilation takes place were determined. The frequency of emission of the $K\overline{K}$ pairs and the energy balance of the various components emitted by the average emulsion nucleus where the annihilation takes place was determined. From these data the total multiplicity of $\pi^{\pm 0}$ for the annihilation of a $\overline{p}$ with an isolated nucleon is deduced under the assumption of charge-independence. An estimate is given of the ratio Σ_n/Σ_p, where Σ_n and Σ_p are the probabilities for a $\overline{p}$ at rest to annihilate with the neutrons and protons bound in the emulsion nuclei. (auth)

8108

APPROXIMATION OF VELOCITY-DEPENDENT POTENTIALS BY SEPARABLE KERNELS. Gy. Targonski (European Council for Nuclear Research, Geneva). Nuovo cimento (10) 14, 1093-1101(1959) Dec. 1. (In English)

The Schroedinger equation for a two-nucleon problem with velocity-dependent forces contains an integral operator, the kernel of which can be approximated by a separable kernel, and then the equation easily solved. A method to construct the best separable approximation is given, the goodness of which is expressed in a simple way with the eigenvalues. It is shown that a reasonable approximation is possible if the first eigenvalue of the kernel is nondegenerate and widely separated from the next one. The properties of the approximation remain unchanged in momentum space representation. (auth)

8109

(n,d) REACTIONS WITH 14 MEV NEUTRONS ON Al^{27}, Ca^{40}, Mn^{55}, Cu^{63}, Rh^{103}. L. Colli (Università, Milan and Centro Informazioni Studi Esperienze, Milan); F. Cvelbar, S. Micheletti, and M. Pignanelli (Università, Milan and Istituto Nazionale di Fisica Nucleare, Milan). Nuovo cimento (10) 14, 1120-9(1959) Dec. 1. (In English)

Deuteron energy spectra from (n,d) reactions at 14 Mev

on the elements Al^{27}, Ca^{40}, Mn^{55}, Cu^{63}, and Rh^{103} are presented. Deuteron peaks corresponding to the fundamental level as well as to some excited levels of residual nuclei are brought into evidence. In Mn and Rh, the existence of gross-structure is shown. (auth)

8110

PHOTONEUTRONS FROM K AND Ca. V. Emma and C. Milone (Università, Catania, Italy and Centro Siciliano di Fisica Nucleare, Catania, Italy) and R. Rinzivillo (Istituto Nazionale di Fisica Nucleare, Naples). Nuovo cimento (10) 14, 1149-56(1959) Dec. 1. (In English)

Photoneutrons from Ca and K irradiated with 31 Mev bremsstrahlung were studied by means of nuclear plates. Neutrons emitted at 90° from Ca and 60°, 90°, and 120° from K are recorded. The spectra show that at least ~50% of the neutrons above 2 Mev are due to direct process. For Ca and for K, a second resonance seems to exist about 10 Mev above the threshold. At 31 Mev, photoneutron yields for Ca and K (neutron/mole · roentgen) at $\theta \sim 90°$ and for $E_n > 2$ Mev are about the same: $(Y_{Ca}/Y_K) \sim 1.1$. (auth)

8111

ON THE PHOTODISINTEGRATION OF THREE-PARTICLE NUCLEI. C. Rossetti (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 14, 1171-3(1959) Dec. 1. (In English)

The two-body photodisintegration cross section of a three-particle nucleus is shown to be very sensitive to its size by studying the behavior of the total cross section as a function of the energy just above the threshold. Threshold energies of the $He^3(\gamma,p)d$ and $H^3(\gamma,n)d$ reactions were calculated to be 5.49 and 6.25 Mev, respectively. (C.J.G.)

8112

NUCLEAR MAGNETIC RESONANCE IN GALLIUM ANTIMONIDE. D. J. Oliver (Services Electronics Lab., Baldock, Herts, Eng.). Phys. and Chem. Solids 11, 257-62 (1959) Oct.

The effects of both n-type and p-type impurities on the resonances of Ga^{69}, Ga^{71}, and Sb^{121} were studied. P-type impurity concentrations of approximately 10^{19} cm^{-3} reduce the resonance intensity by ~60 per cent in Ga^{69} and Ga^{71} and by 75 per cent in Sb^{121}. This reduction is attributed to the quadrupolar interaction between the nuclei and the charged impurity centers and implies fairly large "antishielding factors." The values deduced are 49 for Sb^{121}, 175 for Ga^{69}, and 321 for Ga^{71}. A negative frequency shift of 1.3 kc/s was observed in the Sb^{121} resonance for a p-type impurity concentration of 6×10^{19} cm^{-3}, and a similar shift was observed in an n-type sample (impurity concentration 2×10^{18} cm^{-3}). Both these displacements are ascribed to a second-order quadrupolar effect. No frequency shifts were observed for the gallium resonances. (auth)

8113

ENERGY DEPENDENCE OF FAST-NEUTRON ACTIVATION CROSS SECTIONS. A. E. Johnsrud, M. G. Silbert, and H. H. Barschall (Univ. of Wisconsin, Madison). Phys. Rev. 116, 927-36(1959) Nov. 15.

Fast-neutron capture cross sections of 24 nuclides ranging from A = 51 to A = 197 were measured by an activation method, in the neutron energy region from 0.15 to 6.2 Mev. The neutron energy spreads were of the order of 0.1 Mev so that cross sections averaged over many energy levels of the compound nucleus were measured. Activities induced in samples by fast and thermal neutrons were compared. The relative neutron flux in the fast- and thermal-neutron activations were determined with a U^{235} fission counter. A knowledge of the energy dependence of the U^{235} fission cross section and of the thermal-neutron activation cross sections allows calculation of the fast-neutron activation cross sections. (auth)

8114

CALCULATIONS OF NEUTRON CAPTURE CROSS SECTIONS. C. Mossin-Kotin, B. Margolis, and E. S. Troubetzkoy (Columbia Univ., New York). Phys. Rev. 116, 937-8(1959) Nov. 15.

Neutron capture cross sections are calculated for a number of target nuclei using the statistical theory of nuclear reactions. These calculations are compared with experiment. The different shapes of these capture cross sections as a function of energy are explained in terms of the effect of higher incident neutron partial waves and the competition from inelastic scattering. Using the measured capture sections it is seen that considerable information can be extracted concerning properties of the target and compound nuclei. (auth)

8115

DECAY SCHEMES OF C^{15}, N^{16}, AND O^{19}. D. E. Alburger, A. Gallmann, and D. H. Wilkinson (Brookhaven National Lab., Upton, New York). Phys. Rev. 116, 939-49(1959) Nov. 15.

An iron-free intermediate-image spectrometer was used to measure the beta-ray spectra of 2.25-sec C^{15}, 7.4-sec N^{16}, and 29-sec O^{19} and to measure the positron-electron internal pair conversion lines occurring in C^{15} and N^{16} decays. C^{15} emits a beta-ray branch of end-point energy 9.82 ± 0.04 Mev to the $\frac{1}{2}-$ ground state of N^{15} and a branch of 4.51 ± 0.03-Mev end-point energy. Relative intensities are (32 ± 2)% (log ft = 6.0) and 68% (log ft = 4.1), respectively, and both components have the allowed shape. From pair line measurements at 1.5% resolution the C^{15} gamma-ray energy is 5.299 ± 0.006 Mev, and thus the inner beta-ray group leads to the upper member of the (5.276 – 5.305)-Mev doublet level in N^{15} known from the $N^{14}(d,p)N^{15}$ reaction. The internal pair conversion coefficient derived for the 5.299-Mev line agrees best with an E1 assignment. Our data require spin and parity $\frac{1}{2}+$ or $\frac{3}{2}+$ for the 5.305-Mev level in N^{15}, and spin and parity $\frac{1}{2}+$ or $\frac{3}{2}+$ for C^{15} Taken together with other evidence it seems likely that both states are $\frac{1}{2}+$. No evidence could be found from gamma-ray measurements for the beta decay of C^{15} to other known states of N^{15}. Some comments are made on the intermediate-coupling model for A = 15. In the decay of N^{16} we find that the 3.3-Mev beta-ray branch to the 7.11-Mev level in O^{16} is < 11% per decay, based on the Kurie-plot analysis. A value of (4.7 ± 0.9)% per decay for this branch is derived from the intensity of the 7.11-Mev pair line. O^{19} decays with beta-ray branches of 4.601 ± 0.015 Mev [(41.5^{+2}_{-3})%, log ft = 5.4] and 3.25 ± 0.02 Mev (58.5%, log ft = 4.5). Other results include a value of 5.416 ± 0.015 Mev for the beta-ray end-point energy of F^{20} and a value of 6.051 ± 0.005 Mev for the energy of the pair-emitting state of O^{16}. (auth)

8116

CONVERSION ELECTRON SPECTRUM OF Np^{239} AND LEVEL SCHEME OF Pu^{239}. G. T. Ewan, J. S. Geiger, R. L. Graham, and D. R. MacKenzie (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Phys. Rev. 116, 950-59 (1959) Nov. 15.

The conversion electron spectrum of Np^{239} was studied at resolution settings of 0.1% and 0.05% with a 100-cm radius air-cored $\pi\sqrt{2}$ β-ray spectrometer, using a proportional counter as detector. One hundred and forty-three lines were identified corresponding to Auger transitions

or the internal conversion of γ rays of energies 44.65, 49.41, 57.26, 61.46, 67.86, 88.06, 106.14, 106.47, 181.7, 209.8, 226.4, 228.2, 254.4, 272.9, 277.6, 285.5, 315.9, and 334.3 kev. The results require the addition of a level at 163.75 kev to the basic level scheme for Pu^{239} proposed by Hollander et al. in order to account for three of the weak gamma transitions observed in this work. The relative conversion line intensities are used to determine the transition multipolarities, mixing ratios and expected quantum intensities assuming the K and L shell theoretical conversion coefficients of Sliv. The precisely determined level spacings and the relative transition probabilities are compared in some detail with those expected from an interpretation of the Pu^{239} level scheme in terms of the "Unified Model." New and more accurate K, L, M, and N electron subshell binding energies for Pu were deduced from the experimental data of this work. These values are 20 to 100 ev higher than the values tabulated by Hill, Church, and Mihelich, which were estimated by extrapolation from data at lower Z. (auth)

8117

Cd^{111}–Cd^{113} NUCLEAR MOMENT RATIO AND HYPERFINE ANOMALY. M. P. Klein (Univ. of California, Livermore) and J. S. Waugh (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 116, 960-1(1959) Nov. 15.

A double-resonance method was employed to measure the nuclear moment ratio Cd^{111}:Cd^{113}. The result is $\mu_{113}/\mu_{111} = 1.046083 \pm 0.000003$. This value is compared with recently reported hyperfine coupling intervals. A similar experiment on Hg^{199} and Hg^{201} was not successful. (auth)

8118

NUCLEAR ENERGY LEVELS IN C^{13}, N^{13}, N^{14}, N^{15}, O^{15}, AND F^{18} FROM He^3 INDUCED REACTIONS. T. E. Young, G. C. Phillips, R. R. Spencer, and D. A. A. S. N. Rao (Rice Inst., Houston, Tex.). Phys. Rev. 116, 962-9(1959) Nov. 15.

The Rice Institute 5.5-Mev Van de Graaff accelerator and a magnetic spectrograph were used to study reaction products produced by He^3 bombardment of B^{11}, C^{12}, C^{13}, N^{14}, and O^{16}. Q values of 9.5, 9.3, 6.31, 5.68, 5.63, 5.49, 4.31, 3.67, and 3.29 Mev were observed for the $B^{11}(He^3,p)C^{13}$ reaction, corresponding to excitations of from 3.7 to 9.90 Mev in C^{13}. The energy levels at 7.69 and 8.87 Mev in C^{13}, for which the Q values were 5.49 and 4.31 Mev, were determined to have widths of approximately 75 and 175 kev, respectively. For the $C^{13}(He^3,p)N^{15}$ reaction the observed Q values were 5.38, 4.33, 3.50, 3.36, 3.09, 2.35, 2.09, 1.61, and 1.50 Mev. The $O^{16}(He^3,p)F^{18}$ reaction revealed the existence of twelve states below 3.9 Mev of excitation in F^{18}. These states occur at 0.943, 1.047, 1.089, 1.128, 1.708, 2.102, 2.521, 3.058, 3.130, 3.355, 3.724, and 3.843 Mev of excitation. The ground-state Q values of the $O^{16}(He^3,\alpha)O^{15}$ and $N^{14}(He^3,d)O^{15}$ reactions were determined to be 4.91 and 1.80 Mev, respectively, and the first excited state of O^{15} was observed at 5.17 Mev by means of the $O^{16}(He^3,p)O^{15}$ reaction. (auth)

8119

COMPOUND-ELASTIC SCATTERING OF 4.2-Mev NEUTRONS IN LEAD. P. L. Okhuysen and J. T. Prud'homme (Texas Nuclear Corp., Austin). Phys. Rev. 116, 986-9 (1959) Nov. 15.

Measurements of the differential elastic scattering cross sections of normal lead and radiolead (88% lead-206) for 4.2 ± 0.1 Mev neutrons show a marked difference. Within experimental error this difference appears to be isotropic. It is concluded that the difference is due to compound-elastic scattering in lead-208. (auth)

8120

POLARIZATION OF PROTONS IN $C^{12}(d,p)C^{13}$. R. G. Allas and F. B. Shull (Washington Univ., St. Louis). Phys. Rev. 116, 996-8(1959) Nov. 15.

The polarization of protons from the ground-state $C^{12}(d,p)C^{13}$ reaction was measured over an angular range $\theta_1 = 15°$ to $\theta_1 = 60°$ at a deuteron bombarding energy of 10 Mev. The polarization was found to be positive at all angles studied, the axis of quantization being defined by $n = k_p \times k_d$. The observed polarizations were 18% at 15° (lab); 11% at 18°; 13.8% at 24°; 15.2% at 30°; 19.5% at 36°; 44.4% at 48°; 30% at 54°; 45.8% at 60°. The results are compared with existing polarization measurements on $C^{12}(d,p)C^{13}$. (auth)

8121

SCATTERING OF NEGATIVE MESONS BY HYDROGEN AT 130 AND 152 Mev. U. E. Kruse and R. C. Arnold (Univ. of Chicago). Phys. Rev. 116, 1008-15(1959) Nov. 15.

The elastic scattering and total cross sections for negative π mesons on hydrogen were measured at 130 and 152 Mev. At both energies, the number of electrons arising from the charge exchange scattering were determined with a Cherenkov counter. At 152 Mev, recoil protons were counted, and were distinguished from π mesons by energy loss in a scintillator. The real part of the forward scattering amplitude was determined to be 0.243 ± 0.015 and 0.218 ± 0.016, in units of the meson Compton wavelength, at 130 and 152 Mev, respectively. These values agree within limits of statistical error with the predictions from dispersion relations. (auth)

8122

SCATTERING OF μ MESONS FROM LEAD NUCLEI. B. Chidley, P. Goldstein, G. Hinman, R. Summers, and R. Adler (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 116, 1015-21(1959) Nov. 15.

The angular distribution of 23-Mev μ^- mesons scattered by lead nuclei was measured by using a counter arrangement and also by using a propane bubble chamber. The results agree, to the accuracy of the experiments, with the distribution predicted by the ordinary Coulomb interaction of the μ meson and the lead nucleus. (auth)

8123

SUM-COINCIDENCE TECHNIQUE FOR γ-RAY STUDIES. S. Jha, H. G. Devare, M. Narayana Rao, and Kumari G. C. Pramila (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci., Sec. A 50, 303-13(1959) Nov.

If a radioactive source emitting cascade γ-rays is placed between two well-matched NaI crystal and multiplier units and pulses from the two units are added electronically, one would get, in the added spectrum, a peak corresponding to the sum of the energies of the cascade γ-rays. If the pulses in one of the units are analysed in coincidence with the final sum peak, one would get only the photo-peaks of the cascade γ-rays. This "sum-coincidence" technique was applied to the study of the γ rays of Sc^{46}, Sm^{153}, and Eu^{154}. In Eu^{154} decay, the cascade emission of 320, 1280, and 123 kev γ rays was established; and it was shown that there is a level in Gd^{154} at 1850 kev which is fed by β emission from Eu^{154} to the extent of about 3%. (auth)

8124

DECAY OF Eu^{155}. Kumari S. Y. Ambiye, M. C. Joshi, and B. V. Thosar (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci., Sec. A 50, 342-8(1959) Nov.

Decay of Eu^{155} was studied using an intermediate image β-ray spectrometer, modified to make β-$\bar{e}$ and β-γ coincidence measurements. The following β-groups were ob-

served: 245, 182, and 145 kev. K/L ratio for 86 kev transition is found to be ~2.6. A decay scheme is proposed. (auth)

8125

THE RADIATIVE CAPTURE CROSS SECTION OF ^{232}Th FOR NEUTRONS IN THE ENERGY RANGE 300 to 1200 keV. J. F. Barry, L. P. O'Connor, and J. L. Perkin (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Proc. Phys. Soc. (London) 74, 685-8(1959) Dec. 1.

A determination of the (n,γ) cross section of Th^{232} in the energy region 300 to 1200 kev was made by an activation method. A discrepancy existed between the level structure of this nucleus obtained directly from inelastic scattering measurements and the level structure deduced by Lane and Lynn in their interpretation of radiative capture cross section measurements. The energy dependence of the radiative capture cross section used by Lane and Lynn showed a plateau extending between the neutron energies of 250 and 650 kev followed by a sharp drop. The present measurements show that this plateau actually extends up to about 900 kev so that the (n,γ) cross section is no longer inconsistent with the level structure of Th^{232} deduced from inelastic scattering measurements. (auth)

8126

THE DECAY OF ARSENIC 80. R. E. Meads and J. E. G. McIldowie (Clarendon Lab., Oxford). Proc. Phys. Soc. (London) 74, 693-9(1959) Dec. 1.

Arsenic-80 was produced by the $Se^{80}(n, p)As^{80}$ reaction induced by 14 Mev neutron irradiation of natural Se and enriched Se^{80} samples. The β^- decay to $Se^{80}(t_{1/2} = 15.3$ sec) was investigated by scintillation spectrometry using $\beta-\gamma$ and $\gamma-\gamma$ coincidence techniques. The γ-ray spectra were interpreted in terms of levels in Se^{80} at 0.66, 1.44, 1.52, 1.77 1.88, 2.30, 2.50, and 3.01 Mev. The β-transitions to the ground and first excited states of Se^{80}(log ft values 5.8 and 5.9 respectively) are probably allowed, giving spin 1^+ for the ground state of As^{80}. (auth)

8127

THE POLARIZATION OF PROTONS ELASTICALLY SCATTERED FROM OXYGEN AT 8.7 MEV. M. A. Al-Jeboori, M. S. Bokhari, B. Hird, and A. Strzałkowski (Univ. of Liverpool). Proc. Phys. Soc. (London) 74, 705-10(1959) Dec. 1.

A polarized proton beam was obtained by inserting an internal graphite target in the cyclotron and using the polarization properties of the reaction $C^{12}(d,p)C^{13}$. By scattering this beam from an ice target, the elastic scattering polarization from oxygen at 8.7 Mev was determined at a number of angles. The results show some similarity to the predictions of the optical model but there is evidence of a rapid variation of the polarization with energy. (auth)

8128

THE ANGULAR DISTRIBUTION OF SOME PROTON GROUPS FROM THE REACTION $^{16}O(^3He,p)^{18}F$. S. Hinds and R. Middleton (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Proc. Phys. Soc. (London) 74, 762-7(1959) Dec. 1.

The angular distribution of five proton groups from the reaction $O^{16}(He^3,p)F^{18}$ were measured at incident energies of 5.9 and 9.16 Mev. An attempt was made to explain the observations by a double stripping process and some tentative spin and parity assignments were made. (auth)

8129

SOME ANGULAR DISTRIBUTION MEASUREMENTS ON THE REACTIONS $^{16}O(^3He,d)^{17}F$ AND $^{16}O(^3He,\alpha)^{15}O$. S. Hinds and R. Middleton (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Proc. Phys. Soc. (London) 74, 775-9(1959) Dec. 1.

Angular distributions of α particles from $O^{16}(He^3,\alpha)O^{15}$ were measured at incident energies of 5.70, 5.89, and 9.16 Mev. Results indicate that the reaction proceeds predominantly via a direct process at 9 Mev. The angular distributions measured at 5.70 and 5.89 Mev were very different, suggesting that at energies up to 6 Mev, compound nucleus formation still competes strongly with the direct process. Angular distribution measurements from the $O^{16}(He^3,d)F^{17}$ reaction at an incident energy of 9.16 Mev appeared to be predominantly stripping. (C.J.G.)

8130

THE ENERGY LEVELS OF ^{21}Ne. S. Hinds and R. Middleton (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Proc. Phys. Soc. (London) 74, 779-82 (1959) Dec. 1.

The positions of 67 energy levels from $F^{19}(He^3,p)Ne^{21}$ are reported. Singly charged He^3 with an energy of 5.87 Mev was used to bombard a thin target containing F^{19}. Agreement with other investigations was good for the low-lying levels but many of the higher excited states were shown to be multiplets. The Q-value for the reaction was calculated to be 11.902 ± 0.015 Mev. (C.J.G.)

8131

THE SMALL-ANGLE SCATTERING OF PHOTONS OF ABOUT 100 Mev ENERGY. J. Moffatt and M. W. Stringfellow (Univ. of Oxford). Proc. Roy. Soc. (London) A254, 242-58(1960) Feb. 9.

Differential cross-sections were measured for the scattering of 87-Mev photons by uranium at eight angles in the range from 1.18 to 4.48 mradians and by aluminum, silver, tungsten, lead, and uranium at angles of 1.89 and 4.24 mradians, using a narrowly collimated bremsstrahlung beam. A biased total-absorption Cherenkov counter was used to detect photons with energies near the peak energy of the bremsstrahlung spectrum, and absolute differential cross-sections were measured by comparing counting rates for photons in the primary and scattered beams. The experimental results, with the differential Compton scattering cross-sections of Klein and Nishina subtracted, were analyzed in terms of their variation with angle and atomic number. The results can be described as consisting of a sharply peaked angular distribution with absolute cross-sections varying from element to element as Z^4, together with a uniform distribution varying nearly as Z^2. These distributions were identified with Delbrück scattering and with bremsstrahlung from secondary electrons in the scattering target, respectively. The Delbrück scattering cross-section thus determined is slightly more sharply peaked than the cross-section predicted by an approximate theory of Bethe & Rohrlich. (auth)

8132

NUCLEAR COLLECTIVE MOTION AND THE EFFECTIVE TWO-BODY POTENTIAL. Yoshiyuki Shono and Hajime Tanaka (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto) 22, 177-91(1959) Aug.

An effective two-body interaction is uniquely determined, on the condition that the interaction causes a nucleus to deform. This interaction consists of two terms; one is Elliott's Q-Q interaction and the other a restoring term. It is shown that the interaction causes nuclear rotational levels and the moment of inertia is about Irig/3 in the case of typical nuclear deformation. The formalism is

the dynamical Hartree method and all results are derived in two-dimensional space. (auth)

8133

TENSOR FORCE OF THE PION-THEORETICAL POTENTIAL AND THE DOUBLET SPLITTING IN n-He^4 SCATTERING. Sinobu Nagata, Tatuya Sasakawa, Tatsuro Sawada, and Ryozo Tamagaki (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 274-98(1959) Aug.

To investigate whether the spin-orbit force in the theory of nuclear shell structure is due to the tensor force of the pion-theoretical potential, the doublet splitting of the p-phase shifts in low energy n-He^4 scattering was analyzed. It is concluded that the major part of the experimental doublet splitting can be reproduced by the strong tensor force of the pion-theoretical potential. It is shown qualitatively which features of the pion-theoretical potential are important to the binding energy of He^4 and the discontinuity of the binding energies between He^4 and the system of He^4 plus one nucleon. (auth)

8134

HIGH ENERGY n-He^4 SCATTERING. Yoshiyuki Sakamoto and Tatuya Sasakawa (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 299-301(1959) Aug.

Utilizing the impulse approximation, the differential cross section and the polarization for n–He^4 elastic scattering at 90 Mev were calculated. The effect of the D-state was neglected, resulting in a discrepancy between the calculations and experimental results. (C.J.G.)

8135

NOTE ON ELECTRODISINTEGRATION OF He^4. Toshinosuke Muto, Takashi Sebe, and Ko Izumo (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 22, 304-7(1959) Aug. (In English)

Cross sections of He^4 electrodisintegration were calculated for the range 45 to 105° at 400 Mev and fitted to experiment data on scattered electron energies in the same range. The agreement between calculated and experimental data was good. (C.J.G.)

8136

POSSIBLE EXPLANATION OF THE ENERGY GAP IN THE EXCITATION SPECTRA OF NUCLEI. Tatuya Sasakawa (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 311-12 (1959) Aug.

By predicting first intrinsic excited state for even–even and odd-A nuclei, a statistical explanation of the energy gap in the excitation spectra of nuclei is given. (C.J.G.)

8137

TABLES OF ENERGY VS. MAGNETIC RIGIDITY FOR He^3. A. Barrágan and J. Solt (Universidad Nacional Autónoma, Mexico City). Rev. mex. fís. 8, 229-42(1959). (In Spanish)

Tables of He^3 nuclei energies (kev) versus magnetic field strength times orbit radius were prepared in the range from 50 to 1050 kgauss-cm. (auth)

8138

LITHIUM HYDRIDE BREMSSTRAHLUNG BEAM "HARDENER." E. L. Hart and D. H. White (Cornell Univ., Ithaca, N. Y.). Rev. Sci. Instr. 31, 33-5(1960) Jan.

The attenuation of the low-energy component (below 50 Mev) of the bremsstrahlung beam of a high energy electron accelerator by several low-Z absorbers is studied. In particular, the advantages and construction of a lithium hydride absorber are described. The experimentally measured attenuation is compared with that calculated from a single interaction model, and several further suggestions are offered. (auth)

8139

ON THE ELIMINATION OF THE BARYCENTRIC AND ROTATIONAL COORDINATES IN A NUCLEAR "SHELL-MODEL." Bengt R. Holmberg. Trans. Roy. Inst. Technol., Stockholm 145, 1-27(1959).

Equations are derived for the separation of states in nucleons after the elimination of translational and rotational motion. A "shell-model" may be developed, under certain assumptions concerning the interaction, which permits an exact elimination of the center of mass. This reduction of the independent coördinates implies a corresponding reduction in the number of quantum states at the expense of the lowest shell. (B.O.G.)

8140

STRIPPING REACTION ON NUCLEI OF Be^9, Si^{28}, AND Bi^{209}. N. I. Zaika and O. F. Nemetz (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Ukraïn. Fiz. Zhur. 4, 519-22(1959) July-Sept. (In Ukrainian)

The angular and energy distributions of protons in (d,p) reactions were measured at 13.6 Mev. A simplified selective spectrometer with two plates instead of four, operating with an argon-filled camera where deuteron, triton, and α particle tracks stopped in the first plate with protons passing to the second plate, was used. The scheme of the spectrometer is presented. The angular distribution of protons produced by Be^{10}, Si^{29}, and Bi^{209} transitions is plotted. (R.V.J.)

8141

ENERGY SPECTRUM AND ANGULAR DISTRIBUTION OF THE α PARTICLES OF THE REACTION $B^{11}(p,\alpha)Be^{8*}$ (2.9 Mev) IN THE VICINITY OF THE 163-kev RESONANCE. [PART] I. Detlef Kamke (Universität, Marburg a.d. Lahn, Ger.). Z. Physik 156, 603-20(1959). (In German)

The energy spectrum consists of a broad line (0.8 Mev) at 3.88 Mev and a continuum from 0.05 to 4.9 Mev. The shape of the continuum depends on the angular distributions of the decays taking part in the reaction. The energy spectrum was measured under 90° with respect to the proton beam (CsI + photomultiplier and amplitude discriminator). It shows anisotropies of the α emissions with strong interference in the 163 kev resonance. (auth)

8142

ANGULAR DISTRIBUTION AND ENERGY SPECTRUM OF THE α PARTICLES OF THE REACTION $B^{11}(p,\alpha)Be^{8*}$ (2.9 Mev) IN THE VICINITY OF THE 163-kev RESONANCE. [PART] II. Detlef Kamke (Universität, Marburg a.d. Lahn, Ger.). Z. Physik 156, 621-32(1959). (In German)

The energy spectrum and the angular distribution of the α particles for a measurement of the energy spectrum under 90° with respect to the proton beam were calculated and discussed. (auth)

8143

DETECTION OF A FERMI CONSTITUENT IN THE β DECAY OF Ar^{41} BY POLARIZATION CORRELATION MEASUREMENTS. Th. Mayer-Kuckuk, R. Nierhaus, and U. Schmidt-Rohr (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Z. Physik 157, 586-91(1960). (In German)

The correlation between β particles and circular polarized γ radiation was measured for the $J \rightarrow J\,\beta^-$ transition Ar^{41}–K^{41}. Gaseous sources were used. A correlation coefficient $A = (+0.33 \pm 0.07)$ was found. From this, a ratio of Gamow-Teller to Fermi matrix element $M_G/M_F = +2.3^{+0.9}_{-1.3}$ and a Fermi matrix element

$M_F = 0.09 \pm 0.04$ is derived. The result shows a deviation from the $\Delta T = 0$ isotopic spin selection rule for Fermi transitions. (auth)

8144

THE RATIO OF THE RELATIVE CROSS SECTIONS FOR THE (e,n) AND (γ,n) PROCESS. Rudolf Rodenberg (Universität, Heidelberg, Ger.). Z. Physik 158, 44-76(1960). (In German)

The ratio of the cross sections for the (e,n)- and (γ,n)-process is derived with the use of the relativistic Coulomb eigenfunctions for the continuous spectrum, used by Sommerfeld-Maue and Bethe-Maximon. Only the electric and magnetic dipole transition are considered. For these transitions the Coulomb correction to the Born approximation is calculated. The result of an estimation of the electric quadrupole transition is given. The effect of screening and that of finite nuclear size is estimated. With the ratio thus obtained one is able to calculate the cross sections for the (e,n)- and (γ,n)-process using the experimental values of only one of these quantities. (auth)

8145

RELATIVE MEASUREMENT OF INTEGRATED CROSS SECTIONS FOR THE NUCLEAR PHOTOEFFECT: REACTIONS ON Ca^{40}. K. H. Lindenberger and J. A. Scheer (Universität, Heidelberg, Ger.). Z. Physik 158, 111-19 (1960). (In German)

Metallic calcium has been irradiated by 29 Mev and 34 Mev bremsstrahlung. Yields of the induced activities have been obtained relative to the reaction $C^{12}(\gamma,n)C^{11}$ by measuring the annihilation quanta with a NaI spectrometer. The sum of the cross sections integrated to 33 Mev for the reactions $Ca^{40}(\gamma,n)C^{39}$, $Ca^{40}(\gamma,2n)Ca^{38}$, $Ca^{40}(\gamma,np)K^{38m}$, and $Ca^{40}(\gamma,np)K^{38}$ was determined to be 116 ± 17 Mev mb. At 29 Mev maximum energy the branching ratio $Ca^{40}(\gamma,np)K^{38m}$ to $Ca^{40}(\gamma,np)K^{38}$ was found to be larger than four. As a by product the half lives of Ca^{39}, K^{38m}, and S^{31} were observed to be 0.873 ± 0.008 sec, 0.944 ± 0.012 sec, and 2.61 ± 0.05 sec, respectively. (auth)

8146

MOLECULAR AND ATOMIC BEAMS AT BERKELEY. W. A. Nierenberg (Univ. of California, Berkeley). p.9-42 of "Recent Research in Molecular Beams." Immanuel Estermann, ed. New York, Academic Press, 1959. 194p.

Resonance and resonance decay curves are presented for isotopes of Rb, Cs, Cu, Au, Ag, I, Br, Ga, and Pu as determined by molecular- and atomic-beam studies. (C.J.G.)

8147

COMPARISON OF METHODS FOR THE DETERMINATION OF NUCLEAR SPIN AS APPLIED TO RADIOACTIVE NUCLEI. Victor W. Cohen (Brookhaven National Lab., Upton, N. Y.). p.121-44 of "Recent Research in Molecular Beams." Immanuel Estermann, ed. New York, Academic Press, 1959. 194p.

The various techniques for measuring spin properties as they apply in particular to radioactive nuclei are compared. The methods considered are optical and molecular gas microwave spectroscopy, nuclear and paramagnetic resonance, and atomic beams. The relative merits and limitations of the methods are discussed to show how they supplement each other. (C.J.G.)

8148

THE ATOMIC NUCLEUS. M. I. Korsunskii (Korsunsky). (Translated by G. Yankovskii (Yankovsky). Moscow, Foreign Languages Publishing House, 1958. 413p.

Elementary explanations are given of the identities and properties of radioactive particles and radioactive decay of elements. The basic operating principles of the Geiger counter and the cloud chamber are explained. Early experiments on alpha scattering, disintegrations of nuclei, and production of radioisotopes are discussed. The properties of the positron, the neutrino, and mesons are described. Nuclear fission, chain reactions, and thermonuclear reactions are explained. (C.J.G.)

Particle Accelerators

8149 AD-215596

Air Force Inst. of Tech. Wright-Patterson AFB, Ohio.
LINEAR ELECTRON ACCELERATOR DESIGN (thesis). James T. Westermeier. Mar. 1959. 61p.

The feasibility of variable energy output by varying the frequency for a low energy accelerator is investigated. Although a change in frequency results in a change in phase velocity, it is still possible to achieve time correspondence between the wave and particle, at least over a limited energy range. The energy range of the device is maximized by optimizing certain design parameters to attain an adiabatic variation of velocity with distance along the accelerator. To investigate the feasibility of variable energy output by variation of frequency, it is necessary to make changes in the frequency, calculate the phase velocity at several points along the length of the accelerator, and convert this information to distance vs. time plots. (W.D.M.)

8150 AD-219256

Illinois. Univ., Urbana. Cyclotron Lab.
FIELD HARMONICS IN THE CYCLOTRON MAGNET. Technical Report No. 4. James A. McKee. Mar. 15, 1958. 11p. Contract Nonr-1834(05).

The rebuilt cyclotron uses four flat spiral shims to introduce spiral modulation of the magnetic field in order to improve axial stability and permit independent synchronization of the cyclotron frequency with the frequency of the fixed radiofrequency oscillator. The amplitudes of the various harmonics in the field are of interest in determining the focusing and defocusing effects on the particles. Measurement of the field harmonics are considered. (W.D.M.)

8151 AERE-R-3096

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
EFFECTS OF ROTATIONAL MISALIGNMENTS ON THE RADIAL ACCEPTANCE OF THE LINAC INJECTOR FOR NIMROD. R. Taylor. Oct. 1959. 7p. BIS.

A method is given for computing the radial acceptance of a linac in which the focusing quadrupole magnets may be rotated through arbitrary angles from their nominal position, while retaining their axial location and strengths. Results show that the acceptance should be scarcely affected provided the errors in angular alignment do not exceed one degree. (auth)

8152 AERE-R-3126

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
7 GEV PROTON SYNCHROTRON MAGNET POWER SUPPLY VOLTAGE WAVEFORMS. J. V. Smith. Nov. 1959. 28p. (BIS).

Power supply output voltage waveforms were calculated for various critical operating conditions and for three alternate rectifier circuits. Details of the waveforms are illustrated, and it is shown that one particular circuit gives

the minimum ripple components under all conditions of operation. (auth)

8153 CEA-1081
France. Commissariat a l'Énergie Atomique, Paris.
PROJET D'EJECTION DES PROTONS DE SATURNE. (Proton Ejection Project for "Saturne"). G. Bronca and G. Gendreau. 1959. 176p.

The reasons for choosing the ejection system are given. The characteristics required for the ejected beam are followed by a description of the ejection process, in chronological order from the viewpoint of the protons : movement of the particles, taking into account the various elements which make up the system (internal magnet, external magnet, quadrupoles, ejection correction coils, thin and thick cables, ...) and specification of these elements. Then follows an estimation of the delay in manufacture and the cost of the project. Finally, the characteristics of the magnets and quadrupoles are listed in an appendix. (auth)

8154 CERN-59-38
European Organization for Nuclear Research, Geneva.
PRINCIPE DU SEPARATEUR ELECTROSTATIQUE. (Principle of the Electrostatic Separator). C. Germain. Dec. 7, 1959. 14p.

It is proposed to construct an electrostatic particle separator to be used with a proton synchrotron to supply a purified beam of antiprotons. The separator is actually a velocity spectrometer since it uses a continuous electric field to act on the particles as a function of their velocity. The principle of the device is stated and the optics of the beam feeding the separator is treated. The device and preliminary experiments with a model are described. (T.R.H.)

8155 CF-59-11-3
Oak Ridge National Lab., Tenn.
AN IBM-704 CODE FOR STUDYING PARTICLE ORBITS IN CYCLOTRON FIELDS. H. C. Owens and T. A. Welton. Nov. 2, 1959. 113p. Contract [W-7405-eng-26]. OTS.

A 704 code is described for calculating general orbits in cyclotron fields. The field storage format is identical with that for the previously described equilibrium orbit code, No. 1482. Non-linear effects, with linearization of the axial motion can be very conveniently calculated. (auth)

8156 MURA-538
Midwestern Universities Research Assn., Madison, Wis.
FIELDS EXCITED BY BEAM CURRENTS IN CIRCULAR ACCELERATORS. J. Van Bladel. Dec. 28, 1959. 22p. Contract AT(11-1)-384. OTS.

Formulas are given for the electric and magnetic fields in a circular accelerator of arbitrary cross section, excited by a non-scalloping beam of particles. Both steady-state and step-function transients are considered. (auth)

8157
ELECTRON BEAM IN BETATRON. Miloš Seidl. Czechoslov. J. Phys. 9, 652-65(1959). (In Russian)

The shape of the beam of charged particles in an annular accelerator is derived using a hydrodynamic approximation. Two cases are studied: an equilibrium beam, which is an idealized model of a beam of captured particles, and a non-equilibrium beam, which is formed of injected particles. The experiments carried out on an electron beam in a betatron agree with theory. The term capture efficiency of electrons $\eta = Q/Q_t$ is introduced, where Q is the captured charge and Q_t the maximum charge which can be maintained by the stabilizing forces of the magnetic field. It is shown that in existing betatrons the efficiency η attains only a few percent. (auth)

8158
EQUILIBRIUM STATE OF TOROIDAL ELECTRON BEAM. Miloš Seidl (Research Inst. of Vacuum Electronics, Prague). Czechoslov. J. Phys. 9, 721-35(1959). (In English)

A study was made of the collective behavior of electrons which rotate in a magnetic field used in a betatron. It is shown experimentally that there exists strong interaction between the electrons, which leads to the rapid formation of the equilibrium state with characteristic distribution of the charge density in the cross section of the toroidal beam. The corresponding relaxation time is of the order of 1 μsec. A statistical theory of the equilibrium beam is presented. Its main result is that the effective radius of the beam is a function of two parameters, one of which is proportional to the thermal energy of the electrons and the other to the perveance of the beam. The charge contained in a toroidal beam of given effective cross-section is equal to the product of the charge the beam would contain at zero temperature and a coefficient, which is a function of the temperature of the beam. Its value is unity at zero temperature and rapidly decreases with increasing temperature. The cause of cooling of the beam is shown. (auth)

8159
ELEMENTARY METHOD OF CALCULATING ELECTROSTATIC LENSES. Noel J. Félici (Faculté des Sciences, Grenoble, France and Centre National de la Recherche Scientifique, Paris). J. phys. radium 20, Suppl. No. 12, 97A-109A(1959) Dec. (In French)

The computation of electron lenses has so far been considered as a rather complicated matter, calling for substantial computing facilities. Weak lens formulas were generally discarded by specialists as being unable to give satisfactory results in practical problems. A computing method is described which is, in fact, an extension of the weak lens formulas based on the Picht equation. Even in the case of very strong electrostatic lenses, the numerical error does not exceed a few percent. The most tedious part of the computation is the graphical evaluation of an integral, and does not require more than five to ten minutes. This method enables the average scientist or engineer to get a quick and precise insight into the performance of electron lenses. In the case of weak lenses, new formulas with series expansions are given, and some interesting properties of those lenses are established. (auth)

8160
ELECTRON ACCELERATOR FOR USE UP TO 1 Mev AS A SOURCE OF ELECTRONS AND X RAYS FOR PHYSICO-CHEMICAL STUDIES. Y. Cauchois, H. Bruck, P. Ehinger, A. Gazai, and M. Boivin (Université, Paris). J. phys. radium 20, Suppl. No. 12, 110A-22A(1959) Dec. (In French)

An apparatus is described which was built in the "Laboratoire de Chimie Physique de la Faculté des Sciences de Paris" for obtaining intense beams of x rays and free electrons for research on chemical and physical effects of radiation. The equipment makes use of a high tension cascade generator built for 1.4 Mv and a 14-stage accelerating tube working in air coupled to the generator by means of a distributing potentiometer. It has been used for routine work during the last 2 years and delivers an x-ray dose of the order of 30,000 r/min per mA at a distance of 7.5 cm from the target at 1 Mv; it may be run at a 3 kw permanent load. The electron dose is not yet precisely known but is very high. (auth)

8161
X-RAY DOSIMETRY FOR AN ELECTRON ACCELERATOR OF 0.2 TO 1 Mv. Y. Cauchois, A. Bernas, and A. Gazaï (Université, Paris). J. phys. radium 20, Suppl. No. 12, 123A-30A(1959) Dec. (In French)

Measurements performed to determine the characteristics of the effective x-ray beam delivered by the accelerator are summed up. A study was made of the optimal thickness of the gold target by means of x-ray dosimetry. (auth)

8162
A 160 cm SYNCHRO- AND VARIABLE ENERGY ORDINARY CYCLOTRON. Seishi Kikuchi, Itaru Nonaka, Hiroshi Ikeda Hiroo Kumagai, Yoshio Saji, Junpei Sanada, Shigeki Suwa, Akira Isoya, Izuo Hayashi, Kazuhisa Matsuda, Hisashi Yamaguchi, Takashi Mikumo, Keigo Nishimura, Takashi Karasawa, Shinsaku Kobayashi, Ken Kikuchi, Satoru Ito, Arata Suzuki, Seiichiro Takeuchi, and Hiroshi Ogawa (Univ. of Tokyo). J. Phys. Soc. Japan 15, 41-59(1960) Jan.

A 160-cm cyclotron which can be used as a variable energy ordinary cyclotron as well as a synchro-cyclotron by changing the dee-system and the oscillator system is described. As an ordinary cyclotron it can produce protons of any desired energy between 7.5 and 15 Mev, deuterons between 15 and 21 Mev, and α particles between 30 and 42 Mev. As a synchro-cyclotron, it can produce protons of 57 Mev in energy and the beam is extracted with high efficiency at a radius near n = 1 with an electrostatic deflector. (auth)

8163
THE CONTROL INSTALLATION OF THE BONN SYNCHRO-CYCLOTRON. Hans Twick (Universität, Bonn). Kerntechnik 1, 4-9(1959) July. (In German)

In the development and construction of the control system for the Bonn synchrocyclotron new methods were introduced which deviated from the usual plans in the wiring principles, in the use of switching elements, and in mechanical structures. These are described in detail with a discussion of the series-parallel wiring, interlocks, monitoring, and start-up. (J.S.R.)

8164
CASCADE ACCELERATOR. Detlef Kamke (Universität, Marburg/Lahn, Ger.). Kerntechnik 1, 169-74(1959) Dec. (In German)

The construction principle of the modern cascade accelerator is described. The waviness of the generator was decreased by very symmetric construction and by stabilization of the output voltage up to approximately 1%. Ion sources with sufficiently high yield are available as high-frequency sources. The critical part is the acceleration distance, about which in increasing scope basic calculations and data are available. Therefore the cascade generators are equivalent to the electrostatic accelerators both with respect to energy homogeneity and compact structure, and they have the advantage of large ion currents. (tr-auth)

8165
THE CALCULATION OF LINEAR ENERGY TRANSFER, WITH SPECIAL REFERENCE TO A 14 MEV ELECTRON BEAM AND 10 MEV PER NUCLEON ION BEAMS. Robert H. Haynes and G. W. Dolphin (St. Bartholomew's Hospital Medical Coll., London). Phys. in Med. Biol. 4, 148-58(1959) Oct.

The LET-energy dissipation spectrum and mean LET of a 14 Mev monoenergetic electron beam has been calculated using a method proposed by Burch, and the importance of δ-electrons in such calculations is discussed. The mean LET of the beam is equal to the instantaneous LET of a 1.5 kev electron; its variation with depth in a water phantom is negligible over the first few centimeters. The biological effectiveness of such electrons should not differ significantly from that of Co^{60} γ rays. A short discussion of some calculations for high energy ion beams is also given. (auth)

8166
EXTERNAL BEAM CURRENT MONITOR FOR LINEAR ACCELERATORS. L. Bess, J. Ovadia, and J. Valassis (Michael Reese Hospital, Chicago). Rev. Sci. Instr. 30, 985-8(1959) Nov.

An electron current monitor for linear accelerators was developed. Its sensing element was a toroidal coil through which the beam passes undisturbed. With appropriate electronic circuitry this permitted the true shape of the current pulse to be viewed and also provided an indication of the average beam current on a meter. The average beam current that could be measured ranged from 3×10^{-8} to 3×10^{-6} amp. Furthermore, the use of the current monitor greatly simplified the process of initially obtaining yield from the machine. (auth)

8167
PRECISION CAPACITOR DIVIDER METHOD FOR MEASURING HIGH VOLTAGES. H. V. Larson and H T. Myers (General Electric Co., Richland, Wash.). Rev. Sci. Instr. 30, 1022-4(1959) Nov.

A high-precision capacitor divider method for measuring the voltage on the terminal of a 2-Mv Van de Graaff accelerator is described. Calibration of the system was done using the Be(γ,n) threshold reaction. Linearity was tested using a total beam calorimeter and a beam current integrator. (auth)

8168
USE OF OXIDE-COATED CATHODES IN HIGH CURRENT ELECTRON ACCELERATORS. G. Davidson, S. Ozaki, and R. Weinstein (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Inst. 31, 31-2(1960) Jan.

An investigation was made of the possibility of using an oxide-coated cathode as an electron source for the M.I.T. 320-Mev electron synchrotron. A button cathode originally designed by Sperry Gyroscope Company was redesigned slightly to meet specifications. With this new cathode, an average lifetime of 330 hrs was obtained, operated at peak-pulsed current of 200 ma in vacuums as poor as about 10^{-5} mm Hg. This represents a factor of about 20 improvement in lifetime-current product over directly heated cathodes. (auth)

8169
HIGH-POWER rf WINDOW. K. C. Crebbin and D. F. Mosier (Univ. of California, Berkeley). Rev. Sci. Instr. 31, 64-5(1960) Jan.

The development of a reheatable high-power ceramic window for use in the second linear accelerator at UCRL was outlined. Tests on the final window resulted in a voltage standing-wave ratio (VSWR) in the range 1.01 to 1.03. Windows of this type used on four linacs have operated satisfactorily. Windows which have failed were punctured at a power of about 4 Mw when a magnetron drifted off frequency and produced a large VSWR with a high voltage at the window. (B.O.G.)

8170
VACUUM IN THE SACLAY PROTON-SYNCHROTRON. F. Prevot and R. le Quinio (Commissariat à l'Énergie Atomique, Paris). Vide 14, 197-213(1959) July-Aug. (In French and English)

The design and performance of the vacuum chamber in

the Saclay proton synchrotron are given. The design and performance of the pumping apparatus associated with the vacuum chamber are given. (C.J.G.)

8171
CAVITY EXCITATION CIRCUIT. J. V. Franck (to U. S. Atomic Energy Commission). U. S. Patent 2,909,731. Oct. 20, 1959.

An electronic oscillator is described for energizing a resonant cavity and to a system for stabilizing the operating frequency of the oscillator at the particular frequency necessary to establish a particular preferred field configuration or mode in the cavity, in this instance a linear accelerator. A freely running oscillator has an output coupled to a resonant cavity wherein a field may be built up at any one of several adjacent frequencies. A pickup loop in the cavity is suitably shielded and positioned in the cavity so that only energy at the particular desired frequency is fed back to stabilize the oscillator. A phase and gain control is included in the feedback line.

8172
LOADED WAVE GUIDES FOR LINEAR ACCELERATORS. W. Walkinshaw and L. B. Mullett (to U. S. Atomic Energy Commission). U. S. Patent 2,916,710. Dec. 8, 1959.

A periodically loaded waveguide having substantially coaxially arranged elements which provide an axial field for the acceleration of electrons is described. Radiofrequency energy will flow in the space between the inner wall of an outer guide and the peripheries of equally spaced irises or washes arranged coaxially with each other and with the outer guide, where the loading due to the geometry of the irises is such as to reduce the phase velocity of the r-f energy flowing in the guide from a value greater than that of light to the velocity of light or less.

Plasma Physics and Thermonuclear Processes

8173 AD-217522
Ramo-Wooldridge Corp. Space Technology Labs., Los Angeles.
THERMONUCLEAR PROPULSION. Semi-annual Report [for] July 1, 1958–December 31, 1958. David G. Fladlien. 19p. Contract AF04(647)-165. (GM-TR-0165-00573).

Experimental and theoretical research studies related to thermonuclear propulsion were continued to gain a better understanding of the basic physical laws governing the controlled thermonuclear reaction and its application to rocket propulsion. Considerable effort was expended on further verification of the superfast pinch theory. A one-million-volt power supply was installed on the superfast pinch apparatus to allow the use of higher voltages. Pinches of predicted speed were not achieved. A careful study made of these phenomena suggested further investigations of impurities and of current distribution in the plasma. Studies were continued on two types of shock generator, T-tube and conical tube, and some experimental studies were made on the possible use of the superfast pinch condenser with a transverse pinch geometry. Efforts continued on the experiment for confinement of an electron beam by means of microwaves in a cavity. (auth)

8174 AD-217573
Arizona. Univ., Tucson.
ELECTRICAL AND SPECTRAL CHARACTERISTICS OF HIGH CURRENT SPARK DISCHARGES. Final Report [for] February 20, 1956–February 28, 1959. Leon Blitzer. 28p. DA Project No. 599-01-004. Contract DA-04-495-Ord-434.

A study was made of the electrical and spectral characteristics following breakdown of high-current condensed spark discharges. The discharge current was found to be very nearly the same as in an ordinary LCR circuit. Gap voltages in all cases were observed to fall from initial high values (3.5–6.0 kv) to about 50 v in about 1.0 μsec and to decrease thereafter linearly with time. The gap resistance was found to be very small compared to the resistance of the remainder of the circuit. In general, the electrical parameters were little affected by the material of the electrode. From relative intensities of spectral lines of Fe, I, Ni, and Ti II a study was made of excitation temperatures in the discharge column. In all cases the relative line intensities were consistent with a Boltzmann distribution of the atoms among the excited states. Wide variations in temperature during the history of the discharge point led to an absence of any well-defined equilibrium. At the same time no significant differences were observed from one spectrum to another, calculated temperatures being essentially in the region 6000 to 8000°K both for damped and oscillatory discharges. Preliminary studies of the afterglow radiation indicate an exponential decay of intensity with time, with extreme variations (of the order of 10^5) in relatively short times. (auth)

8175 AD-220086
California Inst. of Tech., Pasadena. Electron Tube and Microwave Lab.
POWER FLOW AND GAP COUPLING TO SLOW WAVE PLASMA MODES. Technical Report No. 12. Gary D. Boyd. June 1959. 38p. Contract Nonr-220(13).

The interaction impedance for the slow wave plasma modes of Trivelpiece and Gould is obtained for a coaxial system of plasma column, surrounding dielectric, and conducting surface. The theory presented includes a finite axial magnetic field. Calculations are presented for the special case of no static magnetic field for the so-called surface wave interaction impedance versus βa. Coupling to the slow wave plasma modes by a known electric field across a gap in the conducting surface at the dielectric surface is analyzed for the coaxial plasma system including a static axial magnetic field. This results in an impedance as seen by the cavity gap. Calculations are presented for the special case of no static magnetic field. (auth)

8176 AFCRC-TN-59-578
Sylvania Electric Products Inc. Microwave Physics Lab., Mountain View, Calif.
IMPROVED MICROWAVE TECHNIQUES FOR MEASURING PLASMA PARAMETERS. Scientific Report No. 1 [on] INVESTIGATION OF NON-LINEAR PHENOMENA ASSOCIATED WITH IONIZED PLASMAS. Jaan Kannelaud and Romayne F. Whitmer. July 22, 1959. 41p. Contract AF19(604)-4083. (AD-225405).

A study is made of microwave methods for performing measurements of plasma characteristics. A discussion is given of the assumptions made in the theoretical analysis and of means for satisfying these conditions experimentally. An experimental arrangement was designed and tested in an attempt to determine the relative importance of experimentally satisfying the various assumptions. It was found that the phase shift measurements (which yield the electron density in the plasma) were relatively insensitive to many of the analytical conditions. However, the plane wave infinite medium assumption imposes serious restrictions on the manner in which attenuation measure-

ments (which yield the electron-neutral particle collision frequency) are performed. (auth)

8177 AFOSR-TN-58-1130
Plasmadyne Corp., Santa Ana, Calif.
THE "PUNCH" METHOD OF COMPRESSING, HEATING AND CONFINING OF A PLASMA. Hendricus G. Loos. Dec. 1958. Contract AF49(638)-335. (T-1TN128-335; AD-207975).

A method of compression, heating, and confinement of a plasma by means of a suddenly applied magnetic field of external origin is explored. The basic cylindrical configuration does not show any instabilities in the hydrodynamic approximation. The number N_1 of ions per unit length along the tube is shown to be related to the amount of separation between plasma and field that is achieved in times small compared with the decay time of the field. Furthermore, this number N_1 determines how many large angle collisions an ion will undergo with other ions during the decay time. Order of magnitude calculations have been made of the energy required for heating by isentropic compression and of the energy and voltage required for shock heating. (auth)

8178 AFOSR-TN-60-49
Oxford Univ. Engineering Lab.
THE RADIATION RESISTANCE OF AN ELEMENTARY DIPOLE IN ANISOTROPIC PLASMAS. Technical Note No. 3. Herwig Kogelnik. [1960]. 16p. Contract AF61 (514)-1183.

A theoretical study is made of the radiation resistance of and the power radiated by an elementary dipole and "short" antennas placed in anisotropic dielectric media such as an ionized gas in a magnetic field. The dependence of these quantities on the dipole's orientation is the same as that of the inverse square root of the distance from the center to the surface of an ellipsoid of revolution. An integral representation for the two extreme values of the radiation resistance was obtained. For special cases of anisotropy, including the case of the uniaxial crystal, these integrals can be evaluated elementarily. For general anisotropy they were evaluated numerically for a set of parameters with the aid of an electronic computer. (auth)

8179 AFOSR-TR-57-20
Forschungsinstitut fur Physik der Strahlantriebe e. V., Stuttgart.
IRREVERSIBLE STOCHASTIC THERMODYNAMICS AND THE TRANSPORT PHENOMENA IN A REACTING PLASMA. Final Report. H. J. Kaeppeler and G. Baumann. Nov. 1956. 104p. Contract AF61(514)-939. (AD-120462).

The investigations presented are a first venture in attempting a theory of transport phenomena in a reacting plasma at elevated and high temperatures. As an essential basis for such studies, the equilibrium behavior of a plasma is treated. These equilibrium considerations concern the influence of electrostatic microfields on plasma properties, termination of the electronic partition function, and determination of the plasma composition. Entering into the problem of energy transport, the classical diffusion theory of transport is discussed. An attempt is made at establishing the rudiments of a stochastic description of plasma physics, the thermodynamics of transport phenomena in particular. It is shown that the theory includes the purely statistical methods. For the calculation of internal energy transport, the formal kinetic theory due to Wang-Chang and Uhlenbeck is extended and approximate methods for integration of the collision integrals are derived. The energy transport in the presence of chemical reactions is treated. (auth)

8180 NP-8234
[Plasmadyne Corp., Santa Ana, Calif.].
THE PLASMA JET AND ITS APPLICATION. Gabriel M. Giannini. [Aug. 2, 1957]. 13p. Contract AF49(638)-54.

The field of plasma physics is reviewed, and the plasma jet is discussed. A plasma generator for use at atmospheric pressures is described. (W.D.M.)

8181 NP-8301
Space Technology Labs., Inc. Physical Research Lab., Los Angeles.
LONGITUDINAL PLASMA OSCILLATIONS IN AN ELECTRIC FIELD. B. D. Fried, M. Gell-Mann, J. D. Jackson, and H. W. Wyld. June 27, 1959. 32p. Contract AF04(647)-309. (TR-59-0000-00760).

The properties of longitudinal plasma oscillations in an external electric field are investigated. In a completely linear approximation, it is found that the direct-current electric field introduces essentially no new effects. A quasi-linear approximation is also considered, in which couplings between different plasma modes are neglected while the space-averaged distribution functions are assumed to be approximately independent of time. In this case, a Maxwellian distribution function is found to be always unstable against the growth of very long wavelength oscillations. (auth)

8182 NP-8305
Space Technology Labs., Inc. Physical Research Lab., Los Angeles.
CONDUCTIVITY MEASUREMENT OF DEUTERIUM PLASMAS AT MAGNETIC REYNOLDS NUMBERS GREATER THAN UNITY. Eugene B. Turner and E. John Eastmond. Dec. 4, 1958. 38p. Contract AF04(647)-165. (GM-TR-0165-00514).

A technique for measurement of plasma conductivity in shock tubes was extended to the range of magnetic Reynolds numbers of greater than unity and was used to measure the conductivities of deuterium and hydrogen plasmas behind shock waves in small tubes. Results of conductivity measurements are tabulated. A discussion of the limitations of the technique is included. (J.R.D.)

8183 RADC-TN-59-81
Sylvania Electric Products Inc. Microwave Physics Lab., Mountain View, Calif.
ELECTROMAGNETIC WAVE PROPAGATION IN HIGH TEMPERATURE PLASMAS. Romayne F. Whitmer. Apr. 9, 1959. 45p. Contract AF30(604)-1944. (AD-214944).

Propagation through high-temperature plasmas was studied for two different types of high-temperature plasmas. In the first type the electrons are at a relatively high temperature, whereas the ions and neutral particles are at, or near, room temperature. In the second type all the constituents of the plasma are at a fairly high temperature. The high electron temperature plasma can be produced by means of microwave breakdown at electron cyclotron resonance. Electrons receive energy very efficiently from the microwave field and lose energy slowly to the other particles. Hence, the neutral particles and ions remain at a relatively low temperature. The second type of plasma can be produced by means of a shock wave. In the region of the shock front all the particles are at a high temperature. Propagation studies will be performed for both types of high-temperature plasmas. However, the propagation measurements reported are limited to the high electron temperature plasma. The microwave measurements include the measurement of attenuation, phase, signal distor-

tion, and harmonic content. Both phases of this program are studied theoretically and experimentally. (auth)

8184 RADC-TN-59-267

Sylvania Electric Products Inc. Microwave Physics Lab., Mountain View, Calif.

ENERGY TRANSFER IN PLASMAS. Technical Note No. 1. R. F. Whitmer. July 15, 1959. 20p. Contract AF30(602)-2050. (AD-226549).

Energy transfer in a hot plasma involves a large number of processes. An evaluation of these processes indicates that those most important are the interaction of electrons with microwave radiation, the conduction of heat, and ionization and molecular excitation accompanied by emission of visible and ultraviolet radiation. Several other effects exist but are probably of less importance. All processes occur simultaneously and, in practical situations, may be impossible to separate because of their strong interdependence. However, two of the processes might, under suitable circumstances, be studied independently of others. These are the propagation of microwave radiation in a plasma of nonuniform temperature and the conduction of heat, the theory of which could be developed along well-established lines. Since collision parameters for electrons, ions, and neutral molecules in an air plasma are not well known, a combination of theory and experiment would be required in order to arrive at a solution. (auth)

8185 UCRL-5738

California. Univ., Livermore. Lawrence Radiation Lab.

THE BUMPY TORUS. Gordon Gibson, Willard C. Jordan, and Eugene J. Lauer. Oct. 1959. 10p. Contract W-7405-eng-48. OTS.

The single-particle motion in the magnetic field created by a circular array of circular current loops is investigated. The extent to which this geometry would have the advantages of closed precessional surfaces which would not intersect the walls and would eliminate end effects is examined. The single particle model is of special interest during the plasma buildup stage in the high-energy injection schemes. Results are limited to investigation of the intersection of the precessional surfaces with the symmetry plane containing the torus. (J.R.D.)

8186 UCRL-8887

California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Livermore. Lawrence Radiation Lab.

CONTROLLED THERMONUCLEAR RESEARCH QUARTERLY REPORT [FOR] JUNE, JULY, AUGUST 1959. Sept. 10, 1959. 143p. Contract W-7405-eng-48. OTS.

Pyrotron Program: The efforts of the group were concentrated on injection studies and on the analysis of plasmas produced by slow magnetic compression. Results included: (1) more detailed analysis of trapped plasmas, showing the effect of magnetic field intensity; (2) the determination of radial distributions of the escaping electron fluxes in Table Top, from which information on radial plasma diffusion can be gleaned, showing that the indicated role of radial diffusion is very small and that the plasma density falls rapidly to a very small value outside a central core about $1\frac{1}{2}$ in. in diameter; (3) the refinement of build-up calculations for the ALICE energetic neutral injection experiment, showing the role of the chamber wall in the build-up and establishing limits on the required pumping. High-energy Injection: The high-energy molecular ion injection scheme involves the use of an axial arc to dissociate the molecular ions. The presence of an arc in the center of a hot plasma will cause a serious drain on the hot ions, via the low-energy electrons in the arc. In order to determine the effect of this energy loss upon the build-up of a hot plasma, the build-up equations were modified to take account of this energy loss. In the Beta-ray Experiment the steady-state bias curves and containment-time measurements were extended to other scattering gases (Ar and Xe). Work on the Bumpy Torus and the Von Ardenne type ion source is reported. Astron Program: In the preceding report a new injection method for the E-layer electrons was mentioned. The theory and the calculations required to evaluate this method were developed during the quarter. The basic idea of the method is to allow the electrons to slide within a potential well while simultaneously losing energy to a suitable arrangement of passive circuits. Astron E-layer calculations are summarized. In the Astron d-c test some minor modifications to the accelerating column of the electron gun resulted in a marked increase in reliability and in much longer periods of operation between shutdowns to clean insulators. Pinch Program: Work is summarized on the linear hard-core pinch, the Levitron, electron beam experiment, plasma accelerator experiments, matrix Marx bank, the 4-inch tubular pinch, switches, the 10-inch Triax, ribbon pinch, Homopolar III diagnostic studies, viscous effects in highly ionized rotating plasmas, and piezoelectric probes. Theoretical Research: A two-pronged series of numerical calculations is being carried out which bears on the general problem of the loss rate of ions due to ion-ion interactions in mirror geometry. A plasma Fokker-Planck equation code, DION, for slowing down of fast ions in a plasma is described which employs an implicit difference scheme and a variable energy mesh size. Basic Experimental Research: Several experiments that involve partially ionized gases are being worked on, partly to aid in the evaluation of phenomena occurring in the devices that produce warm, fully ionized plasmas. Two of these experiments are described. Hydromagnetic wave properties such as velocity, attenuation, impedance, and energy transfer were measured in a cylindrical plasma. Results are compared with theoretical discussions of Alfvén-wave propagation under similar conditions. Experiments on ion-cyclotron resonance heating were continued using a hollow cylinder of plasma, formed by a reflex discharge, in a magnetic mirror. Engineering and Technological Development: Work is summarized on ultra-high vacuum, cryogenic pumping, mechanical engineering, and electrical engineering. (For preceding period see UCRL-8775.) (W.D.M.)

8187 WADC-TN-58-223

Ohio State Univ. Research Foundation, Columbus.

RESEARCH AND DEVELOPMENT IN THERMONUCLEAR REACTIONS. M. L. Pool. May 1958. 150p. Project No. 7116. Contract AF33(616)-5009. (AD-209498).

A review of the unclassified literature in the thermonuclear field was made. Various facets that seemed at one time or another to be potentially useful were explored in considerable detail. An apparatus is suggested for the production and confinement of a plasma. The proposed apparatus is not a duplicate of any existing one in the unclassified or classified areas. The equipment required was arrived at from an over-all view of the fusion field. An estimate is made on the probable operational characteristics of the apparatus and on its possible ultimate development. (auth)

8188 WADC-TN-58-356

Wright Air Development Center. Electronic Components Lab., Wright-Patterson AFB, Ohio.

AUTOMATIC PLOTTING OF ENERGY SPECTRA OF

PLASMA ELECTRONS. George R. Branner. Sept. 8, 1958. 7p. Project No. 4152. (AD-207164).

The purpose of this study was to find a rapid, precise, and reliable method for obtaining the second derivative of the probe characteristic. The theoretical possibility of obtaining the second derivative of the probe I vs. V curve, circuitry to accomplish this task, problems involved, and the discussion of results are outlined. A check on the reliability of the method can be made by a graphical method of differentiation. (auth)

8189 WADC-TR-59-5

Ohio State Univ. Research Foundation, Columbus. A PLASMA-PRODUCING DEVICE. M. L. Pool. Dec. 1958. 72p. Project No. 7116. Contract AF33(616)-5009. (AD-212316).

A plasma device is proposed utilizing a magnetic bottle and a 3-phase oscillator at the cyclotron frequency. The oscillator generates a rotating segment of increased magnetic field which transfers energy to the ions. This raises their velocity without external acceleration and creates new ions in the region by collision, obviating the need for a source. The ions are accelerated in orbits which are contained by the converging magnetic fields of the bottle. (auth)

8190 PA-Trans-55

THEORY OF BROADENING SPECTRAL LINES IN PLASMA. V. I. Kogan. Translated for Picatinny Arsenal. Feitman Research and Engineering Labs. from Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 22, 714-17(1958). 6p. (AD-226827). OTS.

The theory of spectral line broadening in plasma due to the Stark effect is discussed. The disturbance of atoms by electrical fields created by the combination of moving charged particles is taken into account. (J.R.D.)

8191

ON THE THEORY OF THE TEMPERATURE GREEN'S FUNCTIONS. V. L. Bonch-Bruevich and Sh. M. Kogan (Moscow State Univ.). Ann. Phys. (N. Y.) 9, 125-38(1960) Jan.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 18293.

8192

BEHAVIOR OF A HIGH-FREQUENCY PLASMOID IN THE PRESENCE OF A MAGNETIC FIELD. Richard Geller. Compt. rend. 250, 314-16(1960) Jan. 11. (In French)

It was found that high-frequency plasmoids placed in a magnetic field have an instability when the gyromagnetic frequency of the electrons approaches the resonance frequency of the electrons of the plasma. (tr-auth)

8193

EXPERIMENTAL INVESTIGATION OF A HIGH-ENERGY DENSITY, HIGH-PRESSURE ARC PLASMA. Edward A. Martin (Univ. of Michigan, Ann Arbor). J. Appl. Phys. 31, 255-67(1960) Feb.

The underwater spark is utilized to study the fundamental parameters of a plasma at 30,000°K and 10,000 atm pressure. The 25-kv spark is obtained by underwater discharge of capacitors having a stored energy of 1800 joules, the inertia of the water providing the confinement necessary to develop high pressures. Phenomena relating to the initiating wire (exploded wire) are discussed. Kerr cell photographs show that spherical structures are formed around both electrodes under certain conditions. A possible explanation is postulated. A detailed energy balance and particle balance are carried out. The results show that the plasma has great capability to store energy in dissociation, excitation, and ionization without a corresponding increase in temperature. The plasma is 30% ionized and the total particle density is about 2×10^{27} per cubic meter. At this density the plasma radiates a blackbody spectrum. Pressures are obtained by calculation based on the rate of spark channel expansion and the shock properties of water. The plasma is found to have an internal pressure of the same order of magnitude as the external pressure because of interparticle Coulomb forces. Plasma conductivity calculated from equations of Gvosdover and Spitzer and Harm agree very well with the experimental value. The study is basically experimental, with the emphasis in interpretation being placed on reliability of the conclusions rather than on refined accuracy. (auth)

8194

ION ENERGIES IN A COLD CATHODE DISCHARGE IN A MAGNETIC FIELD. John Backus and Norman E. Huston (Univ. of Southern California, Los Angeles). J. Appl. Phys. 31, 400-3(1960) Feb.

A cold cathode discharge in a strong magnetic field was studied by means of a pulsing technique. The discharge was run at pressures of a few microns with magnetic fields of 2400 gauss and currents of the order of half an ampere. By means of a multivibrator and amplifier the discharge was pulsed off for 300 μsec at 1000 μsec intervals. During the off period the current flow to the cathodes was observed. Analysis of the current flow shows an approximately Maxwellian distribution of velocities at the cathodes with a temperature of about 0.5 ev. This gives an ion density in the discharge of approximately 20%. (auth)

8195

ABSORPTION AND REFLECTION SPECTRUM OF A PLASMA. W. D. Hershberger (Univ. of California, Los Angeles). J. Appl. Phys. 31, 417-22(1960) Feb.

A series of absorption and reflection peaks for plasmas, cylindrical in form, and occurring at electron densities lower than that required for the conventional plasma frequency, was reported by various workers such as Tonks, Rommel, and Dattner. This paper describes experiments at a wavelength of 10 cm in which the multiple resonances are observed both within a wave guide and in free space. The electric field of the incident microwave is perpendicular to the axis of the plasma column. The positions of the absorption peaks are given by the interference-dispersion relationship, $2n/(2n + 1) = [1 - (f_0/f)^2]^{\frac{1}{2}}$. The mode spectrum is found by assigning integral values, including zero, to n. When $n = 0$, the conventional plasma frequency f_0 is obtained, but for $n > 0$, the frequencies, and electron densities for higher order modes are obtained. The relationship identifies a distinctive set of ratios between the phase velocity of a plasma wave and the rms velocity of the electrons such that simultaneously the conditions are met for the existence of a standing plasma wave and a stationary pattern of electron motion. Application of the relationship to radar echoes from meteor trails is indicated. (auth)

8196

PENETRATION DEPTH INVESTIGATION OF GAS CLEANUP WITH RADIOACTIVE TRACERS. C. V. Bartholomew (Bell Telephone Labs., Allentown, Penna.) and A. R. LaPadula (Western Electric Co., Allentown, Penna.). J. Appl. Phys. 31, 445(1960) Feb.

Gas cleanup in glow discharges was investigated. It is allied to the phenomenon of ion pumping, in which ions penetrate into the tube electrodes. Cleanup rates were investigated using a radioactive tracer gas, krypton-85. The density of Kr^{85} was found to be 10% at 0.03 mil penetration

depth in a plane nickel cathode. The application of Kr^{85} tracer techniques in the study of gas discharges is continuing. (B.O.G.)

8197

ELECTRON DENSITY AND IONIZATION RATE IN THERMALLY IONIZED GASES PRODUCED BY MEDIUM STRENGTH SHOCK WAVES. Y. Manheimer-Timnat (Israel Ministry of Defence) and W. Low (Hebrew Univ., Jerusalem). J. Fluid Mech. 6, 449-61(1959) Oct.

A method, based on the measurement of attenuation of microwaves, which allows the electron density and the ionization rate of shock-heated gases to be obtained, is described. Results obtained for air in the shock Mach range 8.2 to 10.4, and for nitrogen containing 0.25% oxygen in the range 7.4 to 8.8, show that the electron density is in agreement with theoretical calculations based on thermodynamic equilibrium. Ionization time measurements in air are presented in this range and these results extend the measurements of Niblett & Blackman (1958) to a lower Mach range. (auth)

8198

NONLINEAR OSCILLATIONS OF A PARTICLE IN A LONG WAVE IN A ROTATING FLUID. S.-K. Kao (Univ. of California, Los Angeles). J. Geophys. Research 65, 279-86(1960) Jan.

The effects of a long wave of finite amplitude on the oscillation of a particle in a rotating fluid are examined by solving the Lagrangian equations of motion. It is shown that the motion of the particle is nonoscillatory or oscillatory, depending respectively on whether the forcing frequency kUr is equal to the multiples of the natural frequency or not. In the former case, the zeroth-order solution consists of the natural and forcing frequencies, whereas the first-order solution gives three new frequencies. In the latter case, the zeroth-order solution consists of the natural frequency with linearly growing amplitude, whereas the first-order solution gives a high frequency oscillation of twice the natural frequency with linearly growing amplitude. A comparison of the frequencies predicted by the zeroth-order and first-order solutions and those calculated from the trajectories of 300-mb constant-pressure balloons is made. (auth)

8199

THEORY OF ELECTRON-OSCILLATIONS IN NON-UNIFORM PLASMAS. Masao Sumi (Electrical Communication Lab., Tokyo). J. Phys. Soc. Japan 15, 120-7 (1960) Jan.

For a system consisting of a medium-plasma and an externally injected beam with non-uniform density and temperature, electron-plasma oscillations are described on the basis of linear macroscopic equations. In the one-dimensional case the spatially growing plasma wave and the standing plasma wave are discussed. It is found that in the former a wave propagating toward decreasing density grows up higher than in the uniform case; in the latter the wave-length becomes shorter towards lower density and jumps of mode and frequency occur at a thickness of the layer greater than that in the uniform plasma. Toward increasing density the circumstances mentioned above are reversed. A brief account is given on the two-dimensional case. (auth)

8200

GENERAL THEORY OF ELECTRICALLY CONDUCTING PERFECT GAS FLOW PAST A THREE-DIMENSIONAL THIN BODY. Shigenori Ando (Kawasaki Aircraft Co., Japan). J. Phys. Soc. Japan 15, 157-67(1960) Jan.

General theory of electrically conducting gas past a three-dimensional thin body is presented. Fundamental equations for parametric functions are derived. The magnetic field, the flow velocity, and the pressure are all connected to the parametric function, and so the boundary conditions for the fundamental equation can be written explicitly. The flow over a wavy wall is treated as an application of the present theory in which the applied magnetic field may be in an arbitrary direction. (auth)

8201

A LINEARIZED THEORY OF MAGNETOHYDRODYNAMIC FLOW PAST A FIXED BODY IN A PARALLEL MAGNETIC FIELD. Hirowo Yosinobu (Osaka Univ.). J. Phys. Soc. Japan 15, 175-88(1960) Jan.

A study is made of the flow of a viscous, incompressible and electrically conducting fluid past a fixed body in the presence of a parallel magnetic field. A perturbation method similar to the Oseen approximation in ordinary hydrodynamics is applied to both the flow field and the magnetic field. It proves that the pressure number (namely, the ratio of the magnetic pressure to the dynamic pressure) plays an important role to determine the main features of the field. Calculations are carried out for the flow past a circular cylinder and an approximate formula for the drag per unit span of the cylinder is obtained. (auth)

8202

MAGNETOHYDRODYNAMIC FLOW PAST A SPHERE. Kanefusa Gotoh (Kyoto Univ.). J. Phys. Soc. Japan 15, 189-96(1960) Jan.

The flow of an incompressible, viscous, electrically conducting fluid past a sphere in the presence of a uniform magnetic field parallel to the undisturbed flow is investigated using the Oseen approximation. The drag coefficient is calculated up to the second order of magnitudes of parameters: the Reynolds number R, the magnetic Reynolds number R_m, and the Hartmann number M. Its numerical values are shown graphically for a few typical cases. It is found that the drag coefficient is continuous at the pressure number S = 1; there it changes abruptly in the two-dimensional case. The flow pattern changes remarkably according as the pressure number $S \gtrless 1$. (auth)

8203

ON THE MECHANISM OF THE PINCH EFFECT. T. Goto, M. Sato, and T. Uchida (Nihon Univ., Tokyo). Nuovo cimento (10) 14, 1065-75(1959) Dec. 1. (In English)

Phenomenological analysis of the fast pinch effect is presented and compared with some existing experimental data. The results were derived from a general basic picture of the fast contracting process but independent of its detailed mechanism. (auth)

8204

ON SOME PHENOMENA RELATED TO THE SATURATION OF ROTATIONAL RESONANCES IN THE MICROWAVE SPECTRUM OF OCS. A. Battaglia, A. Gozzini, and E. Polacco (Università, Pisa, Italy). Nuovo cimento (10) 14, 1076-81(1959) Dec. 1. (In English)

An experiment is described which shows the interaction between two electromagnetic fields E_1 and E_2 propagating in a gas, their frequencies ν_1 and ν_2 being close to the frequencies $\nu_{J-1,J}$ and $\nu_{J,J+1}$ of two adjacent rotational resonances, and their intensity being sufficient to perturb appreciably the thermal equilibrium. The shape and the intensity of the line $J \rightarrow J+1$ was modified by the presence of the saturating field of frequency ν_1. Moreover a new resonance was observed, at a frequency $(E_{J+1} - E_{J-1})/h - \nu_1$. This was interpreted as a two quantum effect, i.e.,

as a transition between the J − 1 and the J + 1 levels produced by simultaneous absorption of a photon of frequency ν_1 and a photon of frequency ν_2. (auth)

8205

SCATTERING POTENTIAL IN FULLY IONIZED GASES. O. Theimer and R. Gentry (Univ. of Oklahoma, Norman). Phys. Rev. 116, 787-92(1959) Nov. 15.

Recent methods for calculating the probability W(E)dE that a test particle in a plasma experiences an electrical field of magnitude $E \pm \frac{1}{2}\,dE$ are discussed. In particular, the assumption is analyzed that the distribution W(E) in a system of true charges can be calculated from an auxiliary system of uncorrelated virtual particles which, formally, do not interact although they are the sources of shielded Coulomb fields of the type introduced by Debye and Hückel. It is shown that the electrostatic energy of the auxiliary system, calculated as a volume integral over the average energy density $\langle E^2 \rangle_{Av}/8\pi$, is identical with the interaction energy of the true particles as obtained by the Debye-Hückel theory. The distribution of the micropotential $W(\Psi)d\Psi$ in a plasma is also calculated from the auxiliary system and used for deducing a scattering potential $\Psi(r)$ which has a natural cutoff at a distance equal to the average distance between neighboring ions. An approximate analytical expression for $\Psi(r)$ is given and the physical nature of the scattering potential is discussed. (auth)

8206

THE CURRENT SHEET IN A GAS DISCHARGE. N. J. Phillips (Imperial Coll., London). Proc. Phys. Soc. (London) 74, 700-4(1959) Dec. 1.

A simple theory of the trapping of gas in a 'fast-pinch' gas discharge is given to illustrate the main physical processes involved. In the early stages of a gas discharge, a sheet of current flows near the walls of the discharge tube. This sheet subsequently collapses on to the cold gas inside it, with the consequent compression of the gas. It is shown by a model of the collapse that the efficiency of the trapping of the cold gas within the sheet during the collapse stage increases with the initial gas density. (auth)

8207

RADIAL HYDROMAGNETIC OSCILLATIONS. G. B. F. Niblett and T. S. Green (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Proc. Phys. Soc. (London) 74, 737-43(1959) Dec. 1.

The radial hydromagnetic oscillations of a plasma confined by an axial magnetic field are discussed. Oscillations of this type were recently observed experimentally in this laboratory and typical high speed streak photographs are presented and analyzed. On the assumption that the plasma is confined in a thin cylindrical annulus, the nonlinear equation of motion was integrated analytically. The calculated period of the oscillations is independent of amplitude and was found to be in good agreement with experimental results. Damping of the oscillations by diffusion of the magnetic field is discussed and reference made to the possible significance of the oscillations as a means of transferring energy irreversibly to the ions. (auth)

8208

GIANT CLUSTER EXPANSION THEORY AND ITS APPLICATION TO HIGH TEMPERATURE PLASMA. Ryuzo Abe (Tokyo Inst. of Tech.). Progr. Theoret. Phys. (Kyoto) 22, 213-26(1959) Aug.

The conventional virial expansion of thermodynamic functions is converted into a new expansion scheme, similar to the former but more powerful. The method is particularly suitable to dealing with the interaction of long-range character, such as Coulomb potential, since it suffers from no divergence difficulties contrary to the conventional one. As an application of the method, the equilibrium properties of high temperature plasma are studied and the term of next higher orders than the Debye-Hückel limiting law is obtained exactly. The order estimation indicates that the Debye-Hückel law is accurate within the error of a few per cent in this case. A possible extension of the present method to the theory of non-equilibrium properties of plasma or to quantum statistics is suggested. (auth)

8209

ON THE CALCULATION OF GASOMAGNETIC SHOCK WAVE PARAMETERS. S. A. Kaplan, A. A. Logvinenko, and T. S. Podstrigach (Frank Lvov State Univ.). Ukrain. Fiz. Zhur. 4, 438-42(1959) July-Sept. (In Ukrainian)

An approximate method involving pressures is applied to the solution of a number of problems on the calculation of the parameters of perpendicular gasomagnetic shock waves. Formulas are obtained for density jump, density jump in the reflected wave, velocity of shock wave, and pressure in the compressed region formed by the collision of two magnetized gas masses moving with a relative velocity μ_0. (auth)

8210

TRANSPORT PHENOMENA IN CYLINDRICAL DISCHARGES IN THE PRESENCE OF MAGNETIC FIELDS. J. Friedrich, H. Schirmer, and I. Stober (Osram-Studiengesellschaft, Berlin). Z. Naturforsch. 14a, 1047-56(1959) Dec. (In German)

The complete theory of transport phenomena in cylindrical plasma, in the presence of a longitudinal magnetic field, was constructed with consideration of the self-magnetic field. Under this general assumption the development succeeds up to the second approximation. With consideration of the self-magnetic field or a longitudinal field alone, general expressions were obtained for the nth approximation. The results show that the internal relationship between the corresponding expressions for a Lorentz gas and a plasma is maintained. (tr-auth)

8211

STATISTICAL DESCRIPTION OF COMPLETELY IONIZED PLASMA. H. J. Kaeppeler (Technische Hochschule, Stuttgart). Z. Naturforsch. 14a, 1056-69(1959) Dec. (In German)

The macroscopic equation for a completely ionized plasma was derived from the Liouville equation with the help of the mathematical statistical method. A general Hamilton function for completely ionized plasma, which allows for radiation emission and interaction between radiation and matter, was formulated and was used for the derivation of the Maxwell equations for plasma microfields and of general hydromagnetic equations. By the conception of the solution of the probability density in the Liouville equation as moment problems a system of integral differential equation is obtained for the representation of the partial moments introduced which can be simultaneously the transport magnitudes occurring in the macroscopic equations. The equations of moments were also derived from the Boltzmann equation. Both descriptions are converted into the other and a soluble system of partial differential equations is obtained simultaneously when one averages over the internal field in the plasma and considers only its cumulative effect. This appears permissible for the case when the average free path is large compared with the Debye radius. A discussion was

given on why the equations obtained are not suitable to give a satisfactory description of microscopic phenomena in plasma yet represent a self-closed system for the variation of macroscopic observations, but are also suitable to detect relaxation phenomena from transport magnitudes. (tr-auth)

8212

THE EFFECT OF THE CATHODE SUBLIMATION ON THE ENERGY BALANCE OF A HIGH CURRENT CARBON ARC. E. Hinrichs and R. Wienecke (Universität, Kiel). Z. Physik 156, 592-7(1959). (In German)

The influence of the sublimation of the cathode material of a high-current carbon arc on the energy balance of the arc was investigated approximately in the current intensity range over 400 amp. It was shown that the thermal power necessary for the sublimation corresponds to a supplementary electrical power need. Probe measurements show that the supplementary voltage need of an arc with subliming cathode remains available in the cathode region for the sublimation, heating up, and acceleration of the carbon vapor. (tr-auth)

8213

INVESTIGATIONS OF THE "AURORAL AFTERGLOW" AND STUDIES OF ITS PRODUCTION. I. PREPARATION OF THE DISCHARGE TUBES AND MEASUREMENT APPARATUS. Herbert Heinrich Brömer (Technische Hochschule, Brunswick). Z. Physik 157, 601-12(1960). (In German)

A special apparatus was developed in order to produce an auroral afterglow and to measure the decay of light intensity of some afterglow emissions over several powers of ten. The preparation of different discharge tubes during which the air, the nitric oxide, and the Lewis-Rayleigh afterglow appear also is described. The corresponding spectra are given. (auth)

8214

THE MAGNETODYNAMICS OF CONDUCTING FLUIDS. Third Symposium on Magnetohydrodynamics, Palo Alto, California, November 22 and 23, 1958. Daniel Bershader, ed. Stanford, Calif., Stanford University Press, 1959. 152p.

The effects of electromagnetic and hydrodynamic influences on flow fields "in the large" are explained, with particular reference to aeronautical applications such as the two- or three-dimensional flow past wings. A variety of magnetohydrodynamic waves which can be propagated through a conducting fluid were studied relative to methods of their production and properties. The characteristics of and linear solutions to magnetohydrodynamic wave propagation without radial attenuation are presented. The motion of a fluid in isentropic flow in a transverse magnetic field was examined for the nonsteady one-dimensional irrotational case. The general way in which the magnetic field alters the basic hydrodynamic equations is described. The magnetohydrodynamic effects of forcing an ionizable fluid crosswise through a loosely wound solenoid at supersonic flow were examined. The mechanisms by which electromagnetic phenomena can interact with fluid flows to produce aerodynamic effects were investigated relative to solutions to linear equations governing steady flows. Magnetohydrodynamic flow of an electrically conducting fluid past a flat plate in the presence of a magnetic field is discussed for the cases of steady motion and transient motion that ensue when the plate is set into motion relative to the fluid. (C.J.G.)

Shielding Calculations

8215 NP-8312

Nuclear Shielding Supplies and Service, Inc., White Plains, N. Y.

RADIATION SHIELDING—BIBLIOGRAPHY. 1959. 27p.

A bibliography of 331 references on shielding is presented. (J.R.D.)

8216

THE PASSAGE OF FAST NEUTRONS THROUGH LEAD AND IRON. D. L. Broder, A. A. Kutuzov, V. V. Levin, V. V. Orlov, and A. Z. Turusova. Atomnaya Energ. 7, 313-20(1959) Oct. (In Russian)

Results are presented from measurements made of the spatial distribution of fast neutrons in lead and iron from monoenergetic neutron sources (E_0 = 4 and 14.9 Mev) and from fission. A kinetic equation for neutron attenuating media is used for calculating the spatial energy distributions of fast neutrons at large distances from the source. The anisotropy of elastic scattering is evaluated. The neutron energy losses in elastic scattering are neglected. (tr-auth)

8217

RADIATION-RESISTANT BUILDING BLOCK. Rudolf Alberti. British Patent 826,793. Jan. 20, 1960.

A radiation-resistant building-block design is presented. The block can be used for constructing walls, rooms, or chambers to prevent radiation from penetrating. The block is rectangular with a 120° notch on one end and a 120° point on the other end, making it especially suitable for constructing hexagonal containers. The material used is barite concrete to which a sheet metal casing can be applied with $BaSO_4$ filling. (T.R.H.)

8218

NEW MATERIAL FOR THE SIMULTANEOUS SLOWING DOWN AND ABSORPTION OF NEUTRONS. (to Morgan Crucible Comp. Ltd.). German Patent DAS 1,043,534. Nov. 13, 1958. Atompraxis 5, 501(1959). (In German)

A shielding material for neutrons is described. It is composed of carbon and a boron compound and possesses a high refractoriness and heat conductivity a maximum moderating effect per unit space. Fast neutrons should be completely slowed down by the material and converted into heat energy and slow neutrons. Simultaneously the neutrons should be distributed homogeneously through the material and be absorbed. The material is formed from a mass of carbon, preferably graphite, in which a boron compound is distributed, which is present in the form in which it is solidified from the molten state in situ in this mass. The boron compound can be contained therefore in numerous pores in carbon matrix. A detailed method for the production of this material is given. (J.S.R.)

Theoretical Physics

8219 CERN-59-39

European Organization for Nuclear Research, Geneva.

EVALUATION OF TWO PARTICLE OPERATORS BETWEEN NUCLEAR STATES. T. Kanellopoulos and K. Wildermuth. Dec. 21, 1959. 23p.

A method of calculating the expectation value of the two-particle operators usually involved in nucleon-nucleon interaction between Slater determinants is given. (auth)

8220

THE INTERPRETATION OF QUANTUM MECHANICS.

THE CASE OF THE RELATIVISTIC VELOCITY OF A PARTICLE WITHOUT SPIN. Assène Datzeff. Compt. rend. 250, 67-9(1960) Jan. 4. (In French)

In previous works on probabilistic description of the quantum motion of a micro-particle μ the non-relativistic Schroedinger equation was derived. The idea developed is now used to show that one can find this probabilistic description for μ also for relativistic velocities. (T.R.H.)

8221

SPIN CONFIGURATIONS. Félix Bertaut (Laboratoire d'Électrostatique et de Physique du Métal, Institut Fourier, Grenoble, France). Compt. rend. 250, 85-7 (1960) Jan. 4. (In French)

A direct method and a Fourier method for determining ordered spin configurations are given. (tr-auth)

8222

IMPULSE-ENERGY ELECTROMAGNETIC TENSOR IN THE PRESENCE OF CHARGED MATTER FOR THE CASE OF NON-LINEAR BINDING EQUATIONS OF THE BORN-INFELD THEORY. Nguyen Xuan Xinh. Compt. rend. 250, 468-70(1960) Jan. 18. (In French)

The impulse-energy of an electromagnetic field in the presence of charged matter can be represented by various tensors either symmetric or unsymmetric. While in the Maxwell theory the problem of their choice is still not completely resolved, it is shown that with the binding equations of the Born-Infeld electromagnetic theory these tensors reduce to a single symmetric tensor. (tr-auth)

8223

A GENERALIZATION ON THE TENSORIAL QUANTITIES OF FIELDS OF SPIN 1/2. Kuo-Hsien Tzou (Institut Henri-Poincaré, Paris). Compt. rend. 250, 474-6(1960) Jan. 18. (In French)

The tensorial quantities were deduced for localized fields at different coördinates bound one to the other by C,P,T,M inversions. (tr-auth)

8224

EXTENSION OF THE METHOD OF QUASI-REAL PROCESSES. Paul Kessler. Compt. rend. 250, 477-9(1960) Jan. 18. (In French)

The method of quasi-real processes is extended to the case of a vertex corresponding to production of an extremely relativistic electron pair by a photon. (tr-auth)

8225

ON THE USE OF THE SPHERICAL HARMONICS METHOD IN THE GROUP STUDY OF THE TRANSPORT EQUATION. C. Lo Surdo (SORIN, Milan). Energia nucleare (Milan) 7, 39-52(1960) Jan. (In Italian)

This paper contains a general discussion on the use of the spherical harmonics method for the solution of the transport equation with prompt restitution, when no restriction is made either to the geometry of the problem, or to the nature of the scattering function and of the source, or to the completness of the solution in terms of possible independent solutions. From the energetical standpoint use is made of the classical group method, and the matricial formalism is applied systematically; the general solution results in terms of the eigensolutions of two matricial homogeneous equations, with suitable boundary conditions. (auth)

8226

MEAN WAVE OF A PARTICLE SYSTEM IN FUNCTIONAL THEORY. Florence Aeschlimann (Institut Henri-Poincaré, Paris). J. phys. radium 20, 927-32(1959) Dec. (In French)

Some principles of the functional theory of particles and the properties of the center of masses are discussed. The definitions of mean waves and sum wave are given, in particular the mass mean wave (which corresponds to the center of masses) and the uniform mean wave. The global properties of a system can be expressed with these waves. (auth)

8227

INVERSION OF MASS AND SOLUTIONS OF THE DIRAC EQUATION. K. H. Tzou (Institut Henri-Poincaré, Paris). J. phys. radium 20, 933-6(1959) Dec. (In French)

In Dirac's theory, solutions generated by the mass reversal operation M and by the operators MG are identified, G being the symmetry group {I, P, T, C, and combinations}. (auth)

8228

INTERPRETATION OF WAVE MECHANICS. Louis de Broglie. J. phys. radium 20, 963-79(1959) Dec. (In French)

A restatement is made of the interpretation of the wave mechanic by the double-solution theory. Some results recently obtained are specially made obvious, in connection with new points of view, which commanded attention since 1954-1955. (auth)

8229

INVISIBILITY OF THE LORENTZ CONTRACTION. James Terrell (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 116, 1041-5(1959) Nov. 15.

It is shown that, if the apparent directions of objects are plotted as points on a sphere surrounding the observer, the Lorentz transformation corresponds to a conformal transformation on the surface of this sphere. Thus, for sufficiently small subtended solid angle, an object will appear—optically—the same shape to all observers. A sphere will photograph with precisely the same circular outline whether stationary or in motion with respect to the camera. An object of less symmetry than a sphere, such as a meter stick, will appear, when in rapid motion with respect to an observer, to have undergone rotation, not contraction. The extent of this rotation is given by the aberration angle $(\theta - \theta')$, in which θ is the angle at which the object is seen by the observer and θ' is the angle at which the object would be seen by another observer at the same point stationary with respect to the object. Observers photographing the meter stick simultaneously from the same position will obtain precisely the same picture, except for a change in scale given by the Doppler shift ratio, irrespective of their velocity relative to the meter stick. Even if methods of measuring distance, such as stereoscopic photography, are used, the Lorentz contraction will not be visible, although correction for the finite velocity of light will reveal it to be present. (auth)

8230

ROTATION AND ANGULAR MOMENT OF MULTIPOLAR RADIATION FIELDS. Detlef Kamke (Universität, Marburg, Ger.). Sitzber. Ges. Beförder. ges. Naturw. Marburg 78, 83-95(1955). (In German)

Two properties of electromagnetic multipolar radiation fields which are important in radiation emission problems are the total angular momentum of the fields and their Z components. Both can be calculated quantum mechanically. It was found that for an energy content of just one quantum $h\nu$ the radiation field has an angular momentum of $\sqrt{l(l+1)} \cdot h/2\pi$ (where $l = 1, 2, \ldots$), while the Z component can have $2l + 1$ values of $mh/2\pi$ (where $m = -l, \ldots, l$). The quantities m and l are the indices which show the character of the fields: 2^l specifies the multipole order,

and for each multipole order there are 2l + 1 different fields which can be differentiated in the angular-dependent portions of the field quantities E and H. Since it was of interest to demonstrate how widely quantum-mechanically calculated field properties are already found in classical representations, the question was raised as to whether the obvious interpretation of the angular momentum content of the electromagnetic field as an actual rotation of the field is to be attributed to a fixed reality. This reality is pointed out. (tr-auth)

8231

COLLISIONLESS PLASMA HEATING. Fritz Schneider (European Organization for Nuclear Research, Geneva). Z. angew. Phys. 12, 5-7(1960) Jan. (In German)

By neglecting collisions of plasma constituents with each other, one can make expressions with respect to constant thermal energy supply using periodic working mechanisms. A quasi-periodic heating mechanism is examined which guarantees a constant thermal energy yield. (tr-auth)

8232

TEMPERATURE DETERMINATION IN SPARK DISCHARGES USING TIME-RESOLVED SPECTRA. Helmut Späth and Hans Krempl (Technische Hochschule, Munich). Z. angew. Phys. 12, 8-16(1960) Jan. (In German)

A method of temperature measurement in plasma is described which is based on the fact that for a temperature increase each spectral line first increases in intensity to a maximum, then declines. This intensity-temperature relation was calculated from thermodynamic equations. In a spark discharge, the temperature, a short time after the breakdown of each single spark, where the highest temperature exceeds 40,000°K, is carried to lower values. By relating oscillographically measured intensity verses time to that calculated as a function of temperature, one can determine the temperature as a function of time. (tr-auth)

8233

THE EXPANSION OF THE HARTREE-FOCK APPROXIMATION BY A CORRELATION FUNCTION. Levente Szász (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Naturforsch. 14a, 1014-20(1959) Dec. (In German)

To take into account the correlation between the valence electrons of an atom with N core electrons and two valence electrons, use is made of the trial function suggested by Fock, Wesselow, and Petrashen, $\psi = [1/\sqrt{(N+2)!}]\tilde{A}\varphi_1(1)\varphi_2(2)\ldots\varphi N(N)\,\Phi(N+1, N+2)$. (Here $\tilde{A}$ is the antisymmetric operator, $\varphi_1, \varphi_2, \ldots, \varphi N$ are the atomic core one-electron wave functions, and Φ is the two-electron wave function of the valence electrons.) The question, "Which system of equations will provide one with the best determination of the functions $\varphi_1, \varphi_2, \ldots, \Phi$" is studied. With the aid of the energy minimum principle it is shown that if one neglects the effect of the valence electrons on the atomic core the core electron functions can be determined from the Hartree-Fock equations $H_F\varphi_i = E_i\varphi_i$, ($H_F$ = Hartree-Fock Hamiltonian operator, $i = 1, 2, \ldots, N$) while the valence electron function satisfies the equation: $[H_F(1) + H_F(2) + (1 - \Omega(1,2))(1/r_{12})]\,\Phi = E\Phi$. {The operator $[1 - \Omega(1,2)]$ is a projection operator with the following property: if one expands the function $\Phi(1,2)$ in terms of the functions of the operator $H_F(1) + H_F(2)$ then the operator $[1 - \Omega(1,2)]$ removes the core functions $\varphi_1, \varphi_2, \ldots, \varphi N$ from the expansion.} (auth)

8234

THE EXECUTION OF AN APPROXIMATION OF STRONG COUPLING IN THE CHEW-LOW FORMALISM. Helmut Jahn (Universität, Hamburg). Z. Physik 156, 633-56 (1959). (In German)

A strong-coupling approximation method for the Chew-Low meson-nucleon scattering formalism is developed, considering, for simplicity, the case of charged scalar mesons. As a starting point, the Low equation formulated for the case of strong coupling is stated. This formulation explicitly takes into account the formation of excited compound-nucleon states which arise in the case of strong coupling. The data concerning the zero-meson part and the compound-nucleon excitation energies, necessary to specify this Low equation, are introduced approximately by means of the field-splitting transformation developed in a previous paper. The one meson approximation is constructed; this corresponds to a certain kind of many-meson approximation of the usual Low equation whose limit as $g \to \infty$ holds exactly. It is hoped that these considerations will serve to guide an analogous investigation using the pseudoscalar theory. (auth)

8235

STATISTICAL WEIGHT OF A SYSTEM WITH MANY PARTICLES OF ARBITRARY SPIN. Martin Kretzschmar (Universität, Göttingen, Ger.). Z. Physik 157, 554-7(1960). (In German)

Yeivin and DeShalit derived by combinatorial methods a closed formula for the statistical weight of the states with spin T in a system of many particles with spin ½ and spin 1. Here a group theoretical method of derivation is given, which is applicable—contrary to the combinatorial method—also to more general cases. As an example the formula of Yeivin and DeShalit is generalized for a system of particles with spin ½, spin 1, and spin ³/₂. (auth)

8236

THE THEORY OF WIGNER SUPERMULTIPLETS. Martin Kretzschmar (Universität, Göttingen, Ger.). Z. Physik 157, 558-67(1960). (In German)

The spin and isospin functions of a system of N nucleons were examined and classified into supermultiplets, i.e., in classes of functions with the same symmetry properties in permutations of N nucleons. A simple, but completely general, formula was derived from which one can determine without any intermediate calculations which combinations (S,T) of total spin S and total isospin T are permissible in a supermultiplet with a given permutation symmetry. The derivation of the formula was done by group theoretical methods. The application is completely elementary and requires, essentially, only the explicit writing down of the results. (tr-auth)

8237

APPROXIMATE 3-POINT FUNCTION IN THE HEISENBERG THEORY. K. Just, I. Hartmann, and H. V. Ossowski (Universität, Berlin). Z. Physik 158, 39-43(1960). (In German)

Heisenberg's approximation for the wave function of a fermion is modified by a more extended account for the corresponding function of three field operators. This may also contain a certain type of form factor, although the calculations already finished are done without any dependence on the internal coordinates. The result depends remarkably on the ambiguous sign of the non-linear term in Heisenberg's field equation. (auth)

8238

FUNDAMENTALS OF MODERN QUANTUM PHYSICS. QUANTUM MECHANICS. Gerhard Heber and Gerhard Weber. Leipzig, B. G. Teubner Verlagsgesellschaft, 1959. 143p.

The most important experimental foundations of quantum physics are considered, as well as the most essential basic conceptions of the corresponding theory. A short sketch of the evolution of quantum theory is given. The volume is restricted to quantum mechanics, i.e., wave mechanics, matrix mechanics, and the theory of the electron with spin. A knowledge of classical physics and the mathematics of differential equations is assumed. (W.D.M.)

REACTOR TECHNOLOGY

General and Miscellaneous

8239 BMI-1231

Battelle Memorial Inst., Columbus, Ohio.

NEUTRON-FLUX MEASUREMENTS IN A FLAT PLATE FUEL ELEMENT. Walter R. Morgan, James N. Anno, Jr., and Joel W. Chastain, Jr. Oct. 31, 1957. Decl. Dec. 3, 1959. 50p. Contract W-7405-eng-92. OTS.

The equipment and experiments performed to measure the thermal-neutron-flux distribution in a fuel assembly of an experimental loop mock-up of a gas-cooled reactor at the Battelle Research Reactor (BRR) are described. The loop was located adjacent to the core of the BRR and contained one fuel assembly composed of seven flat fuel plates each containing approximately 29.5 g of U^{235}. The plates consisted of a core 0.050 in. thick of UO_2 dispersed in Type 347 stainless steel and clad on each side with 0.005 in. of Type 347 stainless steel. The measurements showed that with the present design of the loop system an average thermal-neutron flux of 4.09×10^{12} neutrons/(cm^2)(sec) or a power generation of 45 kw in the assembly can be conveniently obtained. The ratio of the peak thermal-neutron flux to average thermal flux in the entire element was found to be 1.87. At any horizontal cross section, thermal-flux depression from the edge of the element to the center of less than a factor of two was observed for the final loop-core arrangement. (auth)

8240 BNL-570

Brookhaven National Lab., Upton, N. Y.

THE NINTH AND TENTH ANNEALING OF THE GRAPHITE MODERATOR STRUCTURE IN THE BNL REACTOR. December 21-22, 1958 (Ninth Anneal); May 30-31, 1959 (Tenth Anneal). R. W. Powell and C. L. Osborne. Changed from OFFICIAL USE ONLY Jan. 7, 1960. 78p. OTS.

Accounts of the ninth and tenth annealings of the BNL Graphite Reactor moderator are given. Temperature traverses through the graphite structure in various channels and at various times during the annealing operation are illustrated. (W.D.M.)

8241 KAPL-2061

Knolls Atomic Power Lab., Schenectady, N. Y.

URANIUM SURFACE CONTAMINATION ON NUCLEAR REACTOR FUEL ELEMENTS. W. M. Cashin, ed. Oct. 23, 1959. 67p. Contract W-31-109-Eng-52. OTS.

Surface U^{235} contamination on nuclear reactor fuel elements is considered. The nature of the contamination and the resultant hazards from plant contamination in the event of a primary system leak are discussed. Methods for detecting and measuring surface contamination are described such as alpha counting, activation analysis, delayed neutron detection, and precise, direct low-level uranium isotopic analysis. Various approaches to decontamination are considered, and the experimental results of several tests presented. (auth)

8242 MSAR-60-6

MSA Research Corp., Callery, Penna.

PRESSURE BUILDUP IN THE VAPOR CONTAINER DURING LOSS OF COOLANT ACCIDENT. Technical Report 70. G. E. Kennedy and V. K. Heckel. Jan. 22, 1960. 15p. Contract NObs-77023.

Pressure build-up in a vapor container during loss of coolant was studied using a Bettis Test Facility (BTF) pressurizer (512 gal) to contain 500°F water under pressure (2000 psig) and then venting its contents to a 10,000 gal tank. A total of seven runs was made using four orifice sizes and two water-to-air volume expansion ratios. One run each was made using a 1/4, 1/2, 3/4, and 1 in. orifice between the pressurizer and the tank and a water-to-air volume expansion ratio of 1.5. Two runs were made using the 1/4 and 1/2 in. orifices with a water to air volume expansion ratio of 4.5 lb water per cu ft of air, and one run with a 3/4 in. orifice and 1.5 lb water per cu ft of air. For this run the tank was stacked with pieces of steel to increase the surface area. The highest pressure obtained, in which all of the water from the pressurizer was vented to the tank, was 38 psig. This was the repeat run where pieces of steel were used to increase the surface area of the tank. The time to reach this pressure was 150 seconds. (auth)

8243 WAPD-TM-186

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

THE PHYSICS AND MATHEMATICAL ANALYSIS FOR THE TUT-T5 MONTE CARLO CODE. J. Spanier. Jan. 1960. 15p. Contract AT-11-1-GEN-14. OTS.

The TUT-T5 code for the IBM-704 estimates neutron capture probabilities in a one-energy, two-dimensional, rectangular cell model, using a Monte Carlo method. The problem and its solution are described in mathematical terms. The transport equation arising from the idealized physical model used in the code is derived and the problem is stated in terms of the solution of this equation. The validity of the Monte Carlo solution is established by proving that the random variables involved are unbiased for processes with convergent Neumann series. These random variables sum the distances travelled by randomly selected particle histories and use these sums to estimate flux integrals over the various regions. Capture probabilities are then obtained through multiplication by the appropriate capture cross sections. The integrals which express the variances of these random variables appear too complicated to handle by analytic methods. (auth)

8244 WAPD-TM-194

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

TWO-REGION REACTIVITY WORTH METHOD FOR ANALYSIS OF FUEL-POISON SUBASSEMBLIES. J. C. Case. Nov. 1959. 10p. Contract AT-11-1-GEN-14. OTS.

In the early production of reactor cores, a final nondestructive method to insure proper loading of fuel-poison subassemblies was desired. Subsequent analytical studies are presented which indicate that two-region reactivity measurements, as obtained from a suitable critical facility, should determine subassembly loading to within 2g U and 0.03g B. Increased confidence in fuel component assembly methods resulted in a decision to abandon use of this method and, as a result, it has never been put into practice at the Bettis Laboratory. (auth)

8245 AERE-Trans-842

A GENERAL FORMULATION OF THE DIFFUSION COEFFICIENT IN A HETEROGENEOUS MEDIUM WHICH MAY CONTAIN CAVITIES. P. Benoist. Translated by I. S.

Grant (U.K.A.E.A. Atomic Energy Research Establishment) from Centre d'Etudes Nucleaires de Saclay, Report SPM-522 Dec. 2, 1958. 77p.

An expression for the diffusion coefficient of monoenergetic neutrons in a heterogeneous medium is derived and shown to be equivalent to the mean square distance of the leakage out of a zone of a reactor. The expression is then used to define the weighting required for the mean free paths. From these expressions a formulation is derived which needs only the probabilities of first collision in the different regions for calculating the principle term; in principle it allows the calculation of both diffusion coefficient and anisotropy. The method is used to set up usable expressions in a lattice consisting of a moderator, a cylindrical annular cavity, and a solid fuel rod; allowance is made for different mean free paths in both rod and moderator and flux variations within the cell. Numerical results for a cell containing natural uranium are compared with those obtained using Behrens' formulas. It is shown that Behrens' formulas underestimate the fast diffusion. Correction terms due to angular correlations between the successive tracks of the neutron during its life are derived. Terms for buckling-dependent corrections were derived. Possible applications of the method for calculating the diffusion coefficient in more complex geometry are given. (C.J.G.)

8246

THE BEHAVIOR OF A REACTOR WITH TEMPERATURE SELF-REGULATION. V. N. Andreev, O. D. Kazachkovskiĭ, and N. V. Krasnoyarov. Atomnaya Energ. 7, 363-6(1959) Oct. (In Russian)

The behavior of a reactor regulated by temperature effects is analyzed. Neutrons were divided into two groups; prompt and delayed. It was assumed that in shutdown the contribution of delayed neutrons drops exponentially with the time. (R.V.J.)

8247

THE DESCRIBING FUNCTION OF NUCLEAR REACTORS. Henri B. Smets (Brookhaven National Lab., Upton, N. Y.). IRE Trans. Nuclear Sci. NS6, 8-12(1959) Dec.

The integro-differential equation of reactor dynamics is studied and approximated. It is found that a reactor can be represented by means of a linear system and a nonlinear system in cascade. The transfer function of the linear system is the classical low-power transfer function. The nonlinear system is a nonlinear amplifier with an exponential characteristic. The describing function is computed in the case of a water-moderated reactor and it is shown that the gain near resonance increases with the magnitude of a reactivity sinusoidal oscillation. (auth)

8248

CALCULATION OF RESONANCE INTEGRAL IN H_2O-MODERATED U–Al ALLOY FUEL REACTOR. Y. Fukai (Nippon Atomic Ind. Group Co., Ltd., [Tokyo]). J. Atomic Energy Soc. Japan 1, 353-8(1959). (In English)

An analytical calculation of the resonance escape probability of the lattice in which H_2O moderator and U-Al alloy fuel are alternately arranged is presented. An approximate formula suggested by G. M. Roe is used for $\phi(t,x)$. Two approximations, infinite mass approximation and scattering model, are used. A resonance integral for the core of a swimming pool type reactor which has 20% enriched U-Al alloy fuels is numerically calculated. Finally, the comparison of numerical results by these approximations and homogeneous treatment is presented. (auth)

8249

CONSTRUCTION OF ANALOG COMPUTERS AND THEIR APPLICATION TO REACTOR TECHNOLOGY. [PART] I. G. Kourim. Kerntechnik 1, 9-14(1959) July. (In German)

After a brief description of the essential elements of an analog computer, the dynamic behavior of reactors was introduced. The differential equations described were derived and corresponding computer wirings were indicated. The case of a cold clean reactor was treated. (tr-auth)

8250

CONSTRUCTION OF ANALOG COMPUTERS AND THEIR APPLICATION IN REACTOR TECHNOLOGY. [PART] II. G. Kourim. Kerntechnik 1, 49-53(1959) Aug. (In German)

The analog study of a cold clean reactor is continued with a consideration of the thermal system. The computer wiring for the study of a hot poisoned reactor is then given. 66 references. (J.S.R.)

8251

THE NUCLEAR REACTOR AS A MEASUREMENT PROBLEM AND CONTROL EXTENSION. Klaus Seifert (Honeywell A.-G., Zurich). Kerntechnik 1, 73-9(1959) Sept. (In German)

Questions of measurement and control on the nuclear part of low-power reactors (research and school) are discussed. Although extensive parallels to experimental and actual power reactors exist, in the present article these are only indicated. The control problems connected with thermal equilibrium in the reactor are not mentioned. (tr-auth)

8252

INTEGRAL TRANSPORT THEORY OF THERMAL UTILIZATION FACTOR IN INFINITE SLAB GEOMETRY. Michel H. Theys (Massachusetts Inst. of Tech., Cambridge). Nuclear Sci. and Eng. 7, 58-63(1960) Jan.

Using transport theory in the cylindrical fuel region of a heterogenous reactor, Amouyal and Benoist proposed new formulas to compute the disadvantage factors used in the determination of the thermal utilization factor. The same method when applied to an infinite slab geometry gives simple expressions for the fuel and moderator disadvantage factors. (auth)

8253

SPACE-DEPENDENT PROMPT KINETICS OF A SUBCRITICAL REACTOR. Joseph Agresta and Lyle B. Borst (New York Univ.). Nuclear Sci. and Eng. 7, 64-8(1960) Jan.

A method of calculating space-dependent reactor kinetics by direct numerical integration of the time-dependent multigroup equations is described. In particular, this method is is applied to study the buildup and decay of neutron flux in a subcritical reactor with a step-function point external source. (auth)

8254

AN APPROXIMATE METHOD FOR TREATING NEUTRON SLOWING DOWN. Gerald Goertzel (Nuclear Development Corp. of America, White Plains, N. Y.) and Eugene Greuling (Duke Univ., Durham, N. C.). Nuclear Sci. and Eng. 7, 69-72(1960) Jan.

The slowing down density, q, of neutrons in a reactor may be decomposed into a sum of parts due to various nuclear species $q = q_1 + q_2 + \cdots$ having corresponding scattering cross sections $\mu_{s1}, \mu_{s2}, \cdots$. An approximate relation between q_i and isotropic flux $\varphi(u)$ (where u is the lethargy) is proposed. $\gamma_i(\partial q_i/\partial u) + q_i = \xi_i \mu_{si} \varphi$. The values of γ_i and ξ_i are derived and interpreted. (auth)

8255

TECHNOLOGIE DES REACTEURS NUCLEAIRES. TOME

I. MATÉRIAUX. (Nuclear Reactor Technology. Volume I. Materials). Paul Ageron, Maurice Gauzit, André Bonaldi, and Thomas Reis. Paris, Eyrolles and Paris, Gauthier-Villars, 1959. 579p.

A review is presented on the nuclear, chemical, physical, and mechanical properties of materials used in reactors and of reactor structural materials. A brief resumé is given at first to make the later chapters useful to the unspecialized reader. A general treatment of radiation effects on matter is then given, followed by chapters on: fissile and fertile materials (U, Th, and Pu, and their chemical processing); non-fissile materials such as Be, BeO, D and D_2O, graphite and other moderators; coolants including Na, Mg, Al, K, Na–K, Rb, Zn, Sn, Ga, and Bi eutectics; neutron absorbers (lanthanides), Cd, B, Hf, and Pt family; shielding materials; and construction materials including Zr and its alloys, stainless steels, Al and its alloys, Mg, Be, Ni and its alloys, Ti, Ta, Mo, W, ceramics, and plastics. (T.R.H.)

8256

CONTROL OF NUCLEAR REACTORS BY MEANS OF NEUTRON-ABSORBING LIQUIDS. Kurt Diebner. German Patent DAS 1,042,145. Oct. 30, 1958. Atompraxis 5, 502 (1959). (In German)

For reactor control, it was proposed to let a neutron-absorbing liquid flow through a system of pipes passing through a reactor. The concentration of neutron absorbers in the liquid could be raised or lowered according to the control problem. The advantage is that no kind of mechanical motion of solid parts must be accomplished within the reactor. (J.S.R.)

8257

SINTERED FUEL ELEMENTS WHICH CAN BE BUILT IN REACTORS WITHOUT CANNING. (to Deutsche Gold- and Silberscheideanstalt vorm. Roessler). German Patent DAS 1,042,773. Nov. 6, 1958. Atompraxis 5, 501(1959). (In German)

Molded bodies prepared by the sintering method should consist of uranium–oxygen compounds with an atomic ratio of U:O of 1:2.05 to 1:2.40. The forms should also be porous. Special advantages would be that such fuel elements could be built in the reactor without cladding and would be placed in direct contact with the heat exchange medium. (J.S.R.)

8258

SIMPLIFIED PRODUCTION OF FUEL ELEMENTS BY POURING POWDERED FUEL MATERIAL IN CANS. (to Siemens-Schuckertwerke AG.). German Patent DAS 1,043,531. Nov. 13, 1958. Atompraxis 5, 501(1959). (In German)

The method described for the production of canned fuel elements consists of the insertion of a one-sided empty case into a recess of a compression-resistant press mold adapted to the geometry of the case. The fuel material in powder form was molded by layers under continuous cold pressing, hot pressing, or sintering with a piston. Powdered metallic or non-metallic fuel materials or a mixture of both could therefore be used. The production of fuel elements should be simplified by the utilization of this method. (J.S.R.)

8259

ELECTRIC ENERGY FROM IONIZING GAS OR VAPOR CURRENTS WHICH WERE FORCED THROUGH A NUCLEAR REACTOR. (to Licentia Patent-Verwaltungs, G.m.b.H.). German Patent DBP 1,046,793. July 9, 1959. Atompraxis 5, 501(1959). (In German)

The method described for the obtention of electrical energy through flowing ionized gas or vapor depends on its charge separation in the air space of a magnetic loop through which the stream was forced with a high velocity. The induced EMF can be tapped with suitable electrodes. In order to obtain a good charge separation and a high degree of efficiency for electricity production, it was proposed to force the gas or vapor to be ionized through a reactor whose radiation would cause ionization. It is advantageous to evaporate the coolant of the reactor, e.g., mercury or liquid sodium, so that they are simultaneously ionized. If the reactor cooling is done by vapor cooling, directly ionized vapor is obtained, which maintains under pressure a high current velocity, gives up its ionization, and after condensation would return to the reactor core for cooling. An additional ionization of the gas or vapor current would result from fission products which are otherwise difficult to use. While at the present electrical energy is produced by the utilization of the heat produced in a reactor in a thermal engine and over a dynamo, with this method it is possible to obtain electrical energy directly from the ionized vapor present in the reactor. (J.S.R.)

8260

NEUTRONIC REACTOR FUEL ELEMENT. D. H. Gurinsky, R. W. Powell, and M. Fox (to U. S. Atomic Energy Comission). U. S. Patent 2,904,454. Nov. 24, 1959.

A nuclear fuel element comprising a plurality of nuclear fuel bearing strips is presented. The strips are folded along their longitudinal axes to an angle of about 60° and are secured at each end by ferrule to form an elongated assembly suitable for occupying a cylindrical coolant channel.

8261

THERMAL FISSION REACTOR COMPOSITIONS AND METHOD OF FABRICATING SAME. A. Blainey (to U. S. Atomic Energy Commission). U. S. Patent 2,907,705. Oct. 6, 1959.

A body is presented for use in a thermal fission reactor comprising a sintered compressed mass of a substance of the group consisting of uranium, thorium, and oxides and carbides of uranium and thorium, enclosed in an envelope of a sintered, compacted, heat-conductive material of the group consisting of beryllium, zirconium, and oxides and carbides of beryllium and zirconium.

8262

NEUTRONIC REACTOR FUEL ELEMENT. W. A. Horning, D. D. Lanning, and D. J. Donahue (to U. S. Atomic Energy Commission). U. S. Patent 2,907,706. Oct. 6, 1959.

A fuel slug for a reactor which acts as a safety device is described. The fuel slug is an aluminum tube with a foil lining the inside surface of the tube, the foil being fabricated of uranium in a lead matrix.

8263

PRODUCING ENERGY AND RADIOACTIVE FISSION PRODUCTS. E. Segre, J. W. Kennedy, and G. T. Seaborg (to U. S. Atomic Energy Commission). U. S. Patent 2,908,621. Oct. 13, 1959.

This patent broadly discloses the production of plutonium by the neutron bombardment of uranium to produce neptunium which decays to plutonium, and the fissionability of plutonium by neutrons, both fast and thermal, to produce energy and fission products.

8264

REACTOR COMPONENT. E. C. Creutz (to U. S. Atomic Energy Commission). U. S. Patent 2,910,177. Oct. 27, 1959.

A reactor fuel element comprised of a slug of fissionable material disposed in a sheath of corrosion resistant-material is described. The sheath is in the form of a tubular container closed at one end and is in tight-fitting engagement with the peripheral surface of the slug. An inner cap is inserted into the open end of the sheath against the slug, which end is then bent around the inner cap and welded thereto. An outer cap is then welded around its periphery to the bent portion of the container.

8265

NEUTRONIC REACTOR. F. Daniels (to U. S. Atomic Energy Commission). U. S. Patent 2,910,416. Oct. 27, 1959.

A reactor in which at least a portion of the moderator is in the form of movable refractory balls is described. In addition to their moderating capacity, these balls may serve as carriers for fissionable material or fertile material, or may serve in a coolant capacity to remove heat from the reactor. A pneumatic system is used to circulate the balls through the reactor.

8266

NEUTRONIC REACTOR. E. C. Creutz, L. A. Ohlinger, A. M. Weinberg, E. P. Wigner, and G. J. Young (to U. S. Atomic Energy Commission). U. S. Patent 2,910,418. Oct. 27, 1959.

A reactor cooled by water, biphenyl, helium, or other fluid with provision made for replacing the fuel rods with the highest plutonium and fission product content without disassembling the entire core and for promptly cooling the rods after their replacement in order to prevent build-up of heat from fission product activity is described.

8267

NUCLEAR REACTOR CONTROL SYSTEM. E. P. Epler, S. H. Hanauer, and L. C. Oakes (to U. S. Atomic Energy Commission). U. S. Patent 2,911,344. Nov. 3, 1959.

A control system is described for a nuclear reactor using enriched uranium fuel of the type of the swimming pool and other heterogeneous nuclear reactors. Circuits are included for automatically removing and inserting the control rods during the course of normal operation. Appropriate safety circuits close down the nuclear reactor in the event of emergency.

8268

METHOD OF MAKING FUEL ELEMENTS. C. H. Bean and R. E. Macherey (to U. S. Atomic Energy Commission). U. S. Patent 2,915,815. Dec. 8, 1959.

A method is described for fabricating fuel elements, particularly for enclosing a plate of metal with a second metal by inserting the plate into an aperture of a frame of a second plate, placing a sheet of the second metal on each of opposite faces of the assembled plate and frame, purging with an inert gas the air from the space within the frame and the sheets while sealing the seams between the frame and the sheets, exhausting the space, purging the space with air, re-exhausting the spaces, sealing the second aperture, and applying heat and pressure to bond the sheets, the plate, and the frame to one another.

8269

NEUTRONIC REACTOR CONTROL. R. S. Dreffin (to U. S. Atomic Energy Commission). U. S. Patent 2,917,444. Dec. 15, 1959.

A control means for a nuclear reactor is described. Particularly a device extending into the active portion of the reactor consisting of two hollow elements coaxially disposed and forming a channel therebetween, the cross sectional area of the channel increasing from each extremity of the device towards the center thereof. An element of neutron absorbing material is slidably positionable within the inner hollow element and a fluid reactor poison is introduced into the channel defined by the two hollow elements.

8270

NEUTRONIC REACTOR CONTROL ROD DRIVE APPARATUS. L. C. Oakes and C. S. Walker (to U. S. Atomic Energy Commission). U. S. Patent 2,917,445. Dec. 15, 1959.

A suspension mechanism between a vertically movable nuclear reactor control rod and a rod extension, which also provides information for the operator or an automatic control signal, is described. A spring connects the rod extension to a drive shaft. The extension of the spring indicates whether (1) the rod is at rest on the reactor, (2) the rod and extension are suspended, or (3) the extension alone is suspended, the spring controlling a 3-position electrical switch.

8271

NUCLEAR REACTOR INCLUDING A PACKAGE SAFETY DEVICE. W. H. Zinn (to U. S. Atomic Energy Commission). U. S. Patent 2,919,236. Dec. 29, 1959.

A safety device is presented for a nuclear reactor which consists of a tube having two chambers separated by a barrier comprising an annulus of stainless steel surrounding a copper disk and a mass of fissionable material in thermal contact with the copper disk. One of the two chambers contains a moderator and is adapted to be located in a region of high reactivity in the reactor and the other chamber contains under high pressure a gas having a high neutron capture cross section and is adapted to be located in a region of low reactivity in the reactor.

Power Reactors

8272 ACNP-ERR-5

Allis-Chalmers Mfg. Co. Atomic Energy Div., Washington, D. C.

ELK RIVER REACTOR. Quarterly Project Report [for] June–July–August 1959. 13p. Contract AT(11-1)-654. OTS.

Progress is summarized on fuel element development, control rods and drives, reactor vessel and components, shielding, instrumentation, reactor building, plant facilities, and construction at site. (See also ACNP-ERR-3.) (W.D.M.)

8273 ANL-5781(Add.)

Argonne National Lab., Lemont, Ill.

HAZARDS EVALUATION REPORT ASSOCIATED WITH THE OPERATION OF EBWR AT 100 MW. E. A. Wimunc and J. M. Harrer. Dec. 1959. 85p. Contract W-31-109-eng-38. OTS.

Basic modifications to the EBWR for increasing the operating design rating of 20 to 100 Mw(t) are covered. Changes and additions to the plant, core, reactor vessel, and other major components are shown. An analysis of the effect of these changes on the performance and safety of the reactor is presented. A re-evaluation of the previous hazards was made, and some additional hazards brought about by the increased power level modification are covered. (W.D.M.)

8274 APAE-Memo-180

Alco Products, Inc., Schenectady, N. Y.

SM-1 (APPR-1) RESEARCH AND DEVELOPMENT PROGRAM; ACTIVITY BUILDUP PROGRAM. TASK I. Status Report [for] February to November 1958. William S.

Brown, C. Richard Bergen, Carl A. Bergmann, Julius Chupak, Louis G. Grant, and Susanne Ryan. Mar. 1, 1959. 158p. Contract AT(30-3)-326. OTS.

Results are given of experimental work performed from February to November 1958 to determine the nature and extent of the build-up of radioactivity in the primary system of the SM-1 (APPR-1). The results of radiochemical and chemical analyses of primary water, circulating crud, and deposits removed from metal test specimens are presented. The relationships between build-up of activity and calendar hours, reactor operation, and crud levels are given. The methods and results of dose rate measurements made on the primary system components are reported. (auth)

8275 APDA-135

Atomic Power Development Associates, Inc., Detroit.

PRELIMINARY REPORT ON SODIUM TEMPERATURE COEFFICIENTS IN LARGE FAST REACTORS. J. B. Nims and P. F. Zweifel. Nov. 1959. 24p. OTS.

Present practice in fast reactor design is to eliminate any known positive temperature coefficients of reactivity. This approach has been feasible for the fast power reactors now being constructed. In recent considerations of advanced fast reactor designs at APDA, some cases were encountered in which the sodium temperature coefficient of reactivity was positive. Because of the serious implications of this result, a study of the sodium temperature coefficient of a design in which the problem appears to be most severe was made. The principle objective of the study was to obtain a better understanding of the problem. Simply stated, reducing the sodium density causes spectral reactivity effects which can, in some situations, be positive and larger in magnitude than the negative leakage effect, thereby causing a positive temperature coefficient of reactivity. In addition, some attention was also given to possible methods of influencing the sign of the sodium coefficient. Although the results indicate that these methods could be successfully applied, there are penalties involved with their use. The results given are believed to be qualitatively correct, but the uncertainties in the cross section data on which they are based cast some doubt on the quantitative accuracy. (auth)

8276 BAW-1083

Babcock and Wilcox Co. Research Center, Alliance, Ohio.

LIQUID METAL FUEL REACTOR EXPERIMENT—TESTING OF SMALL CROLOY 2¼ BELLOWS DESIGNED FOR LIQUID METAL SERVICE. Frank J. Soltys. Oct. 1959. 44p. Contract AT(30-1)-1940. OTS.

Tests were conducted to determine the feasibility of using a bellows-type sealing mechanism in various LMFRE components. Four companies' products were tested under conditions designed to simulate reactor operations. Only one model, a single-ply welded-disc bellows supplied by Company "A," met minimum requirements. Plans to investigate the nature of mass transfer under test conditions were dropped because there was no evidence of this phenomenon. (auth)

8277 BAW-1151

Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.

REACTOR PHYSICS OF THE N.S. SAVANNAH CORE. W. A. Wittkopf and T. M. Schuler. [Dec. 1958]. 21p. Contract [AT(30-3)-274]. OTS.

Presented at the December 1958 Winter Meeting—American Nuclear Society, Detroit.

The nuclear model and the method of analysis used in the nuclear design of the reactor core for the N.S. Savannah are described. (auth)

8278 BMI-1306

Battelle Memorial Inst., Columbus, Ohio.

FURTHER STUDIES WITH THE GCRE CRITICAL ASSEMBLY. David A. Dingee, William C. Ballowe, Richard A. Egen, Francis J. Jankowski, and Joel W. Chastain, Jr. Dec. 29, 1958. Decl. Dec. 3, 1959. 33p. Contract W-7405-eng-92. OTS.

Further engineering and physics data to aid in constructing GCRE-1 were obtained in critical-assembly studies. Four major experiments were performed to investigate the effect on reactivity caused by changes in axial reflector materials, the effect on reactivity and the power perturbation caused by fast safety control-blade guides, the effect of changes in fuel-element material composition, and the effect of changes in fuel-element spacing designed to produce uniform radial power-generation rates. All studies were performed with a 4-in.-thick lead reflector at the core perimeter. Axial-reflector-material studies employed combinations of aluminum and steel reflectors. The reactivity worth of a 2¾-in.-thick steel reflector was +0.414% $\Delta k/k$ compared with 0.175% $\Delta k/k$ for a similar aluminum reflector. The perturbation in the flux distribution caused by the safety-blade guides was localized, and affected only the regions immediately adjacent to the guides. The combined reactivity worth of two guides was −0.281% $\Delta k/k$. Fuel-element material compositions were changed by separate additions of fuel and stainless steel. An increase in uranium loading from an average value of 303 to 404 g per element would provide, based on extrapolations from experimental data, a reactivity of about 4.5% $\Delta k/k$. An increase in steel from 1708 to 2093 g per element decreased the core reactivity by about 1.1% $\Delta k/k$. A change in fuel-element spacing reduced the ratio of maximum to average power generation from 1.46 to 1.24. (auth)

8279 BMI-1311

Battelle Memorial Inst., Columbus, Ohio.

CANNING GRAPHITE FOR GAS-COOLED REACTORS. Stan J. Paprocki, Ronald J. Carlson, and Paul H. Bonnell. Jan. 5, 1959. Decl. Dec. 3, 1959. 16p. Contract W-7405-eng-92. OTS.

A preliminary investigation was made of techniques and materials for canning graphite to protect it for use at high temperatures in a nitrogen–oxygen atmosphere. Fabrication techniques for cladding bare and copper–plated graphite cores either in Type 316 stainless steel or Inconel X were developed. Specimens of the various combinations of core and cladding materials were subjected to simulated-service conditions and evaluated. In all cases the Type 316 stainless steel-clad specimens failed by carburization and subsequent oxidation in relatively short periods of time. Although considerable trouble was experienced with rupture in the vicinity of the cladding welds during thermal cycling of the Inconel X-clad specimens, this material appeared to be satisfactory in other respects and is considered promising. A specimen of silicon-coated graphite clad with Type 316 stainless steel was tested by heat treating for 624 hr at 1800°F. The silicon coating alloyed with the cladding material, formed a high-silicon diffusion zone, but prevented carburization of the stainless steel. (auth)

8280 BMI-1314

Battelle Memorial Inst., Columbus, Ohio.

NEUTRON-FLUX MEASUREMENTS IN A CONCENTRIC-CYLINDER FUEL ELEMENT. James N. Anno, Barry P. Fairand, and Joel W. Chastain, Jr. Jan. 29, 1959. Decl. Dec. 3, 1959. 22p. Contract W-7405-eng-92. OTS.

Neutron-flux measurements in a concentric-cylinder fuel element were made in a gas-cooled in-pile loop operated

adjacent to the core of the BRR. The fuel element comprised four concentric fuel cylinders. Each fuel annulus (outside diameters: 1.248, 1.018, 0.810, and 0.590 in.) consisted of a 0.031-in.-thick core of UO_2 dispersed in type 347 stainless steel and clad on each side with 0.007 in. of type 318 stainless steel. The element was 24 in. long and the total uranium-235 content was approximately 192 g. Radial, vertical, and peripheral flux distributions were studied. The vertical flux profile was cosine-shaped with a peak-to-average ratio of 1.26. The peripheral variation around the loop wall could also be fitted to a cosine curve (with a peak-to-average ratio of 1.10). The average radial flux depression from the outer fuel cylinder to the center of the element was a factor of 2.14. Power generation in the element calculated from flux measurements agreed to within 10% with the power generated by measuring gas flow rate and temperature rise across the fuel element. The ratio of peak-to-average power density was found to be 1.75. (auth)

8281 HW-59758(Rev.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A CALCULATION OF THE REACTIVITY WORTH OF PLUTONIUM AND URANIUM-235 AS ENRICHMENT IN THERMAL REACTORS. D. P. Granquist. Aug. 8, 1959. 34p. Contract AT(45-1)-1350. OTS.

A comparison is presented of the reactivity worth of Pu with the worth of U^{235} as a thermal reactor fuel. Calculations are based on data from four sets of Pu compositions (0, 50, 75, and 90% burned Pu^{239}) mixed with U^{238} and comparable cases with fuel elements enriched in U^{235}. The study was restricted to a single well-thermalized reactor lattice. Effects dependent upon the detailed shape of the thermal neutron spectrum, such as might be significant in close-packed lattices, were not considered. Calculations show that: (1) Pu^{239} has a greater reactivity worth than U^{235} in thermal reactors exhibiting low neutron losses; (2) Pu containing appreciable amounts of its higher isotopes exhibits a greater reactivity worth in low neutron loss thermal reactors than either U^{235} or Pu^{239}; (3) in reactors having high neutron losses ($\bar{k}_\infty/\epsilon = 1.30$), Pu containing appreciable percentages of the higher isotopes cannot attain as long exposures as the corresponding U^{235} enriched fuels; (4) also, in such high neutron loss reactors, U^{235} may have a greater reactivity worth than Pu^{239}; and (5) for intermediate cases ($\bar{k}_\infty/\epsilon = 1.15$ and enrichments of 1.0, 1.5, and 2.0 wt.%) there is little difference in reactivity worth between U^{235}, Pu^{239}, or "burned" Pu. (auth)

8282 IDO-19006

Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.

ABWR CORE PARAMETER STUDY. Dec. 15, 1959. 198p. Contract AT(10-1)-967. (CEND-63). OTS.

This report also serves as Task V portion of the "ABWR Quarterly Progress Report for the Period October 1, 1959 to December 31, 1959; Vol. III. ABWR Design and Development," identified by Report No. IDO-19009.

The development of conceptual designs for several reactor cores which meet the original requirements of the SL-1 Reactor is covered. The SL-1 type conceptual core designs were developed in an attempt to select a satisfactory core material and configuration for application to the PL-1 and PL-2 Reactors. The primary basis for comparison of the various core concepts, assuming technical feasibility in all cores, was core cost, including fabrication and development. The applicability of each of the SL-1 type cores for the PL-1 and PL-2 Reactors was examined in terms of the guidelines for the PL-2 Reactor. (W.D.M.)

8283 MND-M-1853

Martin Co. Nuclear Div., Baltimore.

PM-1 NUCLEAR POWERPLANT; HAZARDS SUMMARY EVALUATION. Oct. 15, 1959. 109p. OTS.

An evaluation was made of the potential hazards associated with the operation of the PM-1 Nuclear Power Plant at Warren Peak, Wyoming. It is shown that the plant operating personnel are protected from radiation hazards through properly designed radiation shielding. The use of detailed operating and maintenance procedures provides a further means of significantly reducing any potential hazards. The analysis of the hazards to the general public following an extreme accident is shown to be within generally accepted tolerances. In particular, the population of Sundance, Wyoming is sufficiently distant so as not to be jeopardized. As a result of these evaluations, it is believed that the PM-1 can be operated at the Warren Peak site without undue risk to the general public or to the Sundance Air Force Station personnel. (auth)

8284 NAA-SR-3936

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

DESIGN OF A CALANDRIA CORE FOR THE SODIUM REACTOR EXPERIMENT. J. B. Williams. Dec. 29, 1959. 51p. Contract AT-11-1-GEN-8. OTS.

The calandria-type replacement core for SRE is designed to operate at 1200°F. Descriptions of the core and the pumpout and vent system are given. Calculations are presented on heat generated in the moderator and reflector, nuclear data on core materials, thermal performance, coolant flow and pressure drop, and nuclear stability. The core mock-up construction is described. (C.J.G.)

8285 NAA-SR-4328

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

REACTIVITY ABSORBED BY XENON-135 IN THE SRE. R. W. Woodruff. Jan. 28, 1960. 21p. Contract AT-11-1-GEN-8. OTS.

The measurement and calculation of the reactivity absorbed by Xe^{135} as functions of time after shutdown for the SRE are described. The measured transient was obtained from critical shim rod configurations. The calculated transient was based on the change in thermal utilization caused by the change in xenon concentration, assuming that the other parameters in k_{eff} remain constant. The xenon concentration was calculated prior to shutdown. The varying reactor power was approximated in 4-hr steps to obtain the concentration present when the power was first reduced to zero. The subsequent concentration was obtained from the radioactive decay law. The measured and calculated transients agreed within 0.14% $\delta k/k$. The calculational technique was applied to various positive and negative step changes in power so that the reactivity absorbed by xenon can be estimated for many reactor conditions. After the reactor scrams from nominal full power, the excess reactivity required for xenon compensation is 2.0% $\delta k/k$. A 4-day waiting time after shutdown is required before the reactivity worth of reactor components can be measured with an accuracy of 0.001% $\delta k/k$ without compensating for xenon. (auth)

8286 NP-8218

Kawasaki Dockyard Co., Ltd., Kobe, Japan and Japan. Ministry of Transportation. Transportation Technology Research Inst., Tokyo.

ON THE EXTERNAL FORCE ACTING ON THE MARINE REACTOR DUE TO THE SHIP MOTION IN ROUGH SEA. E. Kawashima, M. Sakao, and R. Tasaki. Nov. 1959. 14p.

The problem of the external forces acting on a maritime reactor is considered from the viewpoint of component and machinery design. Forces due to vibration or shock and ship motion are discussed. (W.D.M.)

8287 NP-8251

American Electric Power Service Corp., New York and General Nuclear Engineering Corp., Dunedin, Fla.

APPLICATION FOR USAEC LICENSES BY FLORIDA WEST COAST NUCLEAR GROUP. PART A. GENERAL INFORMATION. 40p. PART B. PRELIMINARY HAZARDS SUMMARY REPORT — VOLUME 1. CHARACTERISTICS OF SITE AND ENVIRONMENT. 71p. VOLUME 2. DESCRIPTION OF REACTOR AND PLANT. 181p. VOLUME 3. HAZARDS EVALUATION. 73p. Dec. 7, 1959.

The Florida West Coast Nuclear Group, Inc., plant will be an advanced, high temperature, gas cooled, heavy water moderated reactor of the pressure tube type to be fueled with slightly enriched uranium. The plant is to be designed as a prototype of a 200 Mw(e) nuclear plant which could operate on natural uranium. In order to construct and operate the plant, FWCNG has submitted a combined application for (1) a construction permit, (2) a class 104(b) facilities license, (3) a special nuclear materials license, and (4) a by-product materials license. (W.D.M.)

8288 ORNL-2865

Oak Ridge National Lab., Tenn.

MARITIME REACTOR PROJECT ANNUAL PROGRESS REPORT FOR PERIOD ENDING NOVEMBER 30, 1959. Jan. 25, 1960. 80p. Contract W-7405-eng-26. OTS.

During the report period, the nature of the ORNL supporting activities gradually changed, reflecting the progress in the construction of the N.S. Savannah. Design reviews continued to require considerable attention. The Inspection Engineering Dept. of the Lab. continued to act as an inspection agency for the AEC, witnessing inspections and tests during fabrication of components of the nuclear reactor system. An environmental analysis was made of safeguard aspects of operation of the N.S. Savannah at the NYSC site in Camden. A study of the safety response of the reactor on the ORNL Analog Computer further defined the important role of the Doppler coefficient in controlling reactivity excursions. Health physics aspects of the operation were studied. Limited waste disposal studies indicated that sea disposal of exhausted demineralizer resins may be facilitated by casting the radioactive resins into concrete. Installation of a pressurized-water in-pile test loop in the ORR neared completion. The neutron flux distribution in the loop was determined by experimental measurements in a nuclear mockup of the in-pile section. Metallurgical activities included nil-ductility testing of steel from the reactor vessel, chemical analyses of primary system components, and investigations of the properties of electroless-nickel brazed joints. Limited fabrication studies were carried out on advanced fuel concepts which may have merit for future cores of the Savannah Reactor. Most of the latter effort was applied to swaged UO_2 rod-type elements. A series of physics calculations is being carried out in an attempt to evaluate the possible advantages of using Zircaloy instead of stainless steel as the structural material for Core III. Use of Zircaloy instead of stainless steel for the fuel element cans was found to result in a marked reduction in enrichment for a given initial cold reactivity. (For preceding period see ORNL-2657.) (W.D.M.)

8289 SL-1674

Sargent and Lundy, Chicago.

POWER COST NORMALIZATION STUDIES CIVILIAN POWER REACTOR PROGRAM—Sept. 1, 1959. 270p. OTS.

In connection with the development of a comprehensive plan for a ten-year civilian power reactor program, the AEC has had a series of status reports prepared to present a comprehensive review of the technical and economic status of various nuclear power reactor concepts. In as much as the economic data reported by the various contractors reflected different design philosophies, different estimating policies, and in some cases a technology not verified by the AEC definition of current status, Sargent and Lundy was requested to review the aforementioned status reports and to prepare normalized cost estimates of each of eight reactor concepts. The reactors were studied in three plant sizes: 75, 200, and 300 Mw(e). The reactor concepts considered were pressurized water, boiling water, organic cooled, sodium graphite, liquid metal cooled, fluid fuel (aqueous homogeneous), heavy water moderated, and gas cooled. (W.D.M.)

8290 TID-8500(Pt. I)(Suppl.)

Ebasco Services, Inc., New York and General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.

BOILING WATER REACTOR STUDY—REFINEMENTS OF 306 Mw POWER REACTOR CONCEPTUAL DESIGN. June 1959. 50p. Contract AT(10-1)-1010. OTS.

(Previously available as IDO-24030, App. 1).

The objectives of the study were to review the designs and costs of the 306 Mw selected BWR and to determine the effect of refinements on plant performance and costs. The following refinement studies are presented: steam reheat, plant shielding requirements, size of reactor enclosure, review of reactor enclosure location, review of major piping, steam quality optimization, transient heat transfer, maximum fuel temperature limits, fuel and core arrangements, heat balance modifications, turbine extraction steam heaters, and reviews of generator main lead design, plant instrumentation and control, prices of major equipment, equipment shipments, and construction schedule. (W.D.M.)

8291 TID-8500(Pt.2)(Suppl.)

Ebasco Services, Inc., New York and General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.

BOILING WATER REACTOR STUDY—SEPARATE STUDIES. June 1959. 107p. Contract AT(10-1)-1010. OTS.

Previously available as IDO-24032.

A study was made to determine the feasibility of installing reheat steam facilities in conjunction with a selected 306-Mw boiling water reactor nuclear power plant. The equipment required for steam reheating includes moisture separators, shell and tube type reheaters, drain tanks, intercept and reheat stop valves, turbine design modifications, insulation, and complete piping system. It is concluded that there is no economic merit in the use of steam reheat. (W.L.H.)

8292 TID-8500(Pt. 4)

Ebasco Services, Inc., New York and General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.

BOILING WATER REACTOR STUDY—100 Mw BOILING WATER REACTOR CONCEPTUAL DESIGN. June 1959. 95p. Contract AT(10-1)-1010. OTS.

Previously available as IDO-24032.

The objective of the study was to determine the capital and energy costs of a 100-Mw dual cycle, boiling water reactor and associated complete electrical generating plant consistent with a schedule calling for start of construction in July 1960. Ground rules prescribed by the AEC include

a plant life of 30 years and an annual load factor of 80%. Conceptual design criteria, capital cost estimates, energy cost estimates, design and construction schedules, variations in cost as a function of unit size, operating characteristics, and safety aspects are presented. (W.D.M.)

8293 WCAP-1354

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC. CVTR PROJECT. Monthly Progress Report [for] November 1959. 29p. OTS.

A number of design decisions were reached which will be reflected in consideration of changes in the design of some of the systems. A study layout was prepared of a top mounted control rod drive mechanism utilizing a rigid linkage. Design calculations were started for the substitution of an iron thermal side neutron shield in place of the present light water shield. Corrosion tests on Ag–In–Cd, Ag–In–Cd–Sn, and borated stainless steel were continued. Analysis of fuel assembly pressure drop data obtained in Loop E indicated that pressure drops were excessive with 4 and 8 inch spacer wire patches. The changes in the top neutron shield design necessitated extending the thermal baffles in the U-tubes into this region in order to reduce the moderator heat losses. (See also WCAP-1346.) (W.D.M.)

8294 WCAP-4002

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC. CVTR PROJECT. Monthly Progress Report [for] December 1959. 28p. OTS.

The irradiation schedule for the rabbit capsules to be inserted in WTR was established. A detailed review of various types of both top- and bottom-mounted, upward- and downward-scramming control rod drive mechanisms was conducted. Procurement activities on the components for the critical facility proceeded at an accelerated pace. The Zircaloy-to-stainless steel transition joint was moved to a point higher on the pressure tube so that none of the stainless steel portion of the joint extends into the reflector region. The transitions and U-bend baffle connections with the pressure tube and U-bend were modified. Hydraulic testing of nine experimental orifice plates was begun in Loop E. Calculations confirmed that the exit enthalpies in the fuel assembly flow channels for a 19 rod cluster arranged in a hexagonal lattice are less than when arranged in a circular lattice. (For preceding period see WCAP-1354.) (W.D.M.)

8295 YAEC-88

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

BULK BIOLOGICAL SHIELDING ASPECTS OF THE YANKEE CORE. H. W. Graves, Jr., W. J. Eich, and H. T. Williams, Jr. Oct. 1957. 37p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. OTS.

The analysis of the radiation sources within the primary concrete shielding of the Yankee Atomic Electric Plant is summarized. The dose due to these sources at a point on a transverse centerline and outside the plant container was calculated. The dose at two points on the axial centerline was found as well as the extent to which the water is activated during its passage through the pressure vessel. (auth)

8296

STEAM-RAISING UNITS FOR GAS-COOLED POWER REACTORS. S. L. Wijnbergen. Atoomenergie 1, 199-210 (1959) Dec. (In Dutch)

The heat exchanger systems of the EDF-1 and EDF-2 power stations have been the subject of systematic study on all phases involved in the design and construction of a heat exchanger. As is shown, heat transfer performance was improved, pressure drops reduced, manufacturing processes made simple and inexpensive, and mass production methods utilized. Such improvements are almost indispensable, with respect to future power stations, where power densities in the reactors will be increased and the total volume of heat exchangers will become so great that they constitute the bottleneck in the construction of power stations. (auth)

8297

BREEDING—HOW SOON A NECESSITY? W. K. Ergen (Oak Ridge National Lab., Tenn.) and E. L. Zebroski (General Electric Co., San Jose, Calif.). Nucleonics 18, No. 2, 60-6; 87(1960) Feb.

Two points of view are presented concerning the necessity of breeder reactors coupled with the presently available fossil and fissionable fuel supplies. One sees the need at 40 years and the other at a century, but both concepts are linked with the economic feasibility of the production of nuclear power at costs competitive with present-day prices. Both concepts envision the necessity for breeder reactors before fuel reserves are depleted. (B.O.G.)

8298

GAS-COOLED NUCLEAR REACTOR. (to United Kingdom Atomic Energy Authority). British Patent 825,521. Dec. 16, 1959.

A gas-cooled reactor system is described. The 1.1-in.-diam. slug elements lie in horizontal channels in graphite. A loading-unloading mechanism is also described. (T.R.H.)

8299

NUCLEAR POWER PLANT HAVING HETEROGENEOUS NUCLEAR REACTORS. (to Sulzer Freres). British Patent 826,591. Jan. 13, 1960.

A nuclear power plant arrangement is described in which heat is withdrawn from the moderator and exchanged to the liquid cooling system to heat make-up coolant. (T.R.H.)

8300

MULTISTAGE FLUIDIZED BED REACTOR. A. A. Jonke, J. E. A. Graae, and N. M. Levitz (to U. S. Atomic Energy Commission). U. S. Patent 2,911,290. Nov. 3, 1959.

A multistage fluidized bed reactor is described in which each of a number of stages is arranged with respect to an associated baffle so that a fluidizing gas flows upward and a granular solid downward through the stages and baffles, whereas the granular solid stops flowing downward when the flow of fluidizing gas is shut off.

8301

NUCLEAR REACTOR. J. J. Grebe (to U. S. Atomic Energy Commission). U. S. Patent 2,917,443. Dec. 15, 1959.

A reactor which is particularly adapted to serve as a heat source for a nuclear powered aircraft or rocket is described. The core of this reactor consists of a porous refractory moderator body which is impregnated with fissionable nuclei. The core is designed so that its surface forms tapered inlet and outlet ducts which are separated by the porous moderator body. In operation a gaseous working fluid is circulated through the inlet ducts to the surface of the moderator, enters and passes through the porous body, and is heated therein. The hot gas emerges into the outlet ducts and is available to provide thrust. The principal advantage is that tremendous quantities of gas can be quickly heated without suffering an excessive pressure drop.

Production Reactors

8302 ORNL-2666
Oak Ridge National Lab., Tenn.
A STUDY OF GRAPHITE-MODERATED Th–U^{233} BREEDER SYSTEMS. A. M. Perry, C. A. Preskitt, and E. C. Halbert. Feb. 2, 1960. 26p. Contract W-7405-eng-26. OTS.

A study was made of a graphite-moderated two-region Th–U^{233} breeder reactor. The most important single variable determining the achievable breeding ratio is the C:U^{233} atomic ratio. This involves a balance between high parasitic capture in graphite for a high C/U ratio and a low average value of η of U^{233} for a low C/U ratio. Results of the study indicate that, with chemical losses taken into account, a breeding ratio of unity is attainable. Values of η of U^{233} used for the energy range above about 10 ev may prove to be too low, and in that event a positive breeding gain and a reasonably short doubling time may be achieved. (auth)

8303 RDB(W)TN-93
United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.
MEASUREMENT OF THE NEUTRON FLUX DISTRIBUTIONS ACROSS A LATTICE CELL IN THE WINDSCALE PILES. R. R. Gallie and E. Smart. 1958. Date of MS. Sept. 1953. 14p.

Uranium detectors were irradiated in the rods and the moderator of a cell in the Windscale Piles. From measurements of the activity induced in the detectors by irradiations bare and under cadmium, the effective sub-cadmium fission flux distribution was determined. The ratio of maximum to average flux in a uranium rod was found to be 1.3 and the ratio of maximum flux in the moderator to average flux in uranium was found to be 1.6. The estimated accuracy of these results is ±10 per cent. (auth)

Research Reactors

8304 AD-215598
Air Force Inst. of Tech., Wright Patterson AFB, Ohio.
GAMMA-RAY SPECTRAL DETERMINATION IN THE TEST FACILITIES OF THE AIR FORCE NUCLEAR ENGINEERING TEST REACTOR (thesis). Joseph Pidkowicz. Mar. 1959. 66p.

The lack of adequate gamma-ray measurements for radiation effects studies on materials has seriously hindered correlation of results and understanding of the processes involved. A survey of the instruments previously used for reactor gamma-ray measurements has uncovered 3 methods: (1) a magnetic spectrometer, (2) a single crystal spectrometer, and (3) a multiple-crystal spectrometer. Each of these are evaluated against the criteria set forth for spectral determinations. The multiple crystal spectrometer was selected to obtain the spectrum. The theory of the instrument and its operational problems are well known and the equipment is considered reliable. (auth)

8305 IDO-16535
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
ETR FAST NEUTRON FLUX MEASUREMENTS $\phi > 1$ Mev. C. H. Hogg and L. D. Weber. Jan. 8, 1960. 68p. Contract AT(10-1)-205. OTS.

The fast neutron fluxes ($\phi > 1$ Mev) in selected positions of the ETR were measured for Cycles 13A and 10. Flux maps of the ETR tank and traverses for all positions monitored are included. The measurements for Cycle 10 include data for a clean core and a fully depleted core. The theory on which the adopted measurement techniques are based is also described. (auth)

8306 NP-8299
Illinois. Univ., Urbana. Coll. of Engineering.
HAZARDS ANALYSIS FOR A TRIGA MARK II TRAINING AND RESEARCH NUCLEAR REACTOR TO BE INSTALLED AT THE UNIVERSITY OF ILLINOIS, URBANA. Oct. 1959. 123p. OTS.

A study of the elimination and control of potential hazards arising from a proposed reactor installation at the University of Illinois is presented. Criteria for the installation include maximum flexibility for experiments, inherent safety, and the capability for isotope production. Explanations of the safety and control features of the reactor (TRIGA), as well as the special precautions taken in building design to complete operational safety of the whole installation, are presented. (J.R.D.)

8307 NP-8308
Wisconsin. Univ., Madison. Coll. of Engineering and General Electric Co. Atomic Power Equipment Dept., [San Jose, Calif.].
PRELIMINARY HAZARDS ANALYSIS OF WISCONSIN POOL-TYPE REACTOR. Report No. 14. Max W. Carbon and E. G. Holzmann. Aug. 1959. 82p. OTS.

The characteristics and proposed installation of a 10-kw pool-type nuclear reactor at the University of Wisconsin are described. The reactor is being designed, constructed, and installed by General Electric Co. Experimental facilities include two complete 6-inch beam ports. Descriptions of the reactor and its operating characteristics, the building, the site, the operational procedures, proposed experiments, and an evaluation of the hazards involved are presented. (W.D.M.)

8308 NP-8326
National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
NASA PLUM BROOK REACTOR FACILITY. PARTS I, II, AND III. Final Hazards Summary. A. B. Davis, B. Lubarsky, and T. M. Hallman, eds. Dec. 1959. (230p. (Pt.I), 208p.(Pt.II), 218p.(Pt.III)). OTS.

These three parts were issued separately, but are cataloged as a unit. $31.80(ph), $9.30(mf) OTS.

The Lewis Research Center of NASA has built a research reactor near Sandusky, Ohio. Information is provided concerning the design of the reactor facility, the characteristics of the site, the hazards of operation at this location, and general operating and emergency procedures. The 60-Mw reactor is light water-cooled and -moderated of the MTR-type with a primary Be reflector and a secondary water reflector. Experiments which may eventually be operated in the facility are discussed. (W.D.M.)

8309
DEVELOPMENTS AT WINFRITH HEATH, ZENITH REACTOR COMPLETED. Chem. & Ind. (London) No. 29, 920-2(1959) July 18.

A description of the Zenith reactor is given. The Zenith exponential experiments and the Dragoon project are described. (C.J.G.)

8310
UTILIZATION OF RESEARCH REACTORS IN CHEMISTRY. A. H. W. Aten, Jr. Chem. Weekblad 54, 642-4(1958). (In Dutch)

The utilization of research reactors in chemistry can be divided into four categories: the utilization of the reactor to make measurements, utilization of the nuclear fission process, utilization as neutron producer, and utilization of

the gamma radiation. The specific areas of use of each of these categories are discussed briefly. (J.S.R.)

8311

IRRADIATIONS IN THE MUNICH RESEARCH REACTOR. [PART] I. W. Schilling, T. Springer, and M. Pollermann. Kerntechnik 1, 21-8(1959) July. (In German)

The significance of reactor irradiation technology is briefly indicated by a survey of the areas of utilization. The Munich Research Reactor is then discussed as a radiation source with a consideration of the neutron flux, the gamma flux, and the spatial distribution of the neutrons. (J.S.R.)

8312

IRRADIATIONS IN THE MUNICH RESEARCH REACTOR. [PART] II. W. Schilling. Kerntechnik 1, 54-60(1959) Aug. (In German)

The effect of the reactor radiation on samples is discussed with emphasis on the activation and heating of the sample and on radiation damage. (tr-auth)

8313

IRRADIATIONS IN THE MUNICH RESEARCH REACTOR. III. RADIATION DAMAGE FROM IRRADIATION IN THE REACTOR. W. Schilling. Kerntechnik 1, 119-26(1959) Oct. (In German)

In the last part of the article the formation of radiation damage is considered in the evaluation of the effects of reactor radiation. (tr-auth)

8314

HOT RELOADING OF IN-PILE TESTS. H. K. Ruhl (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 18, No. 2, 96(1960) Feb.

Efforts to develop long-life power-reactor cores must include studies of long-term exposures of fuel materials. It is desirable, for pertinent information, that incremental irradiation effects be observed on a single assembly several times throughout the exposure period. Included are some adaptations used at the MTR for hot reloading a blind horizontal beam hole and for a vertical testing facility. (B.O.G.)

WASTE DISPOSAL AND PROCESSING

8315 AEEW-M-24

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Establishment, Winfrith, Dorset, England.

THE WINFRITH EFFLUENT PIPELINE. G. H. Palmer. Nov. 20, 1959. 9p.

The preparatory work leading to the design of the Winfrith pipeline is described. Details of the existing system are given, and some information on the predicted safe levels of radioactive discharge is included. (auth)

8316 IDO-14484

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

VENTURI SCRUBBER EVALUATION FOR WASTE CALCINATION OFF-GAS FACILITIES. B. R. Wheeler. Dec. 18, 1959. 26p. Contract AT(10-1)-205. OTS.

Development studies concerned with treatment of off-gas from the waste calcination facilities currently being installed at the Idaho Chemical Processing Plant are described. Fission products contained in dust from the calciner make an essentially 100 per cent gas-solid separation mandatory. Calcination conditions determine the size and concentration of solids in the off-gas. Data from the evaluation of Venturi scrubbers on a pilot plant calciner show that all but 1.6×10^{-3} grains of solids per cubic foot of gas can be removed. The tests with a Venturi scrubber independent of the cold calciner indicate that a gas containing only 7.5×10^{-5} grains of solids per cubic foot of gas may be attained at the expense of 18 inches Hg pressure drop across the Venturi scrubber. Evaluation of Venturi scrubber data indicated that scrubbing efficiency is principally dependent upon over-all pressure drop, rather than upon high scrub volume in relation to aerosol volume in itself. (auth)

8317 AEC-tr-3951

ELIMINATION OF WEAKLY RADIOACTIVE LIQUID EFFLUENTS BY DILUTION: THEIR CONSEQUENCES. (Elimination par Dilution d'effluents Liquides Faiblement Radioactifs: Leurs Consequences). P. Bovard and C. Candillon. Translated for Oak Ridge National Lab. from a publication of the French Atomic Energy Commission, 1959. 21p. JCL or LC.

Nuclear installations frequently have to resolve problems posed by the elimination of considerable volumes of weakly radioactive liquid effluents. The techniques used by all nuclear centers in France are to discard the effluents in natural or artificial hydrographic systems in such a manner that they are diluted to the maximum degree. Mechanisms of concentration of radioactivity were studied with the intention of perfecting sampling methods for control measurements. (W.L.H.)

8318

TREATMENT OF RADIOACTIVE WASTES. Stefan Krawczynski. Gas- u Wasserfach 100, No. 36, 8p. (1959). (In German)

A discussion is presented of sampling, storing, decontaminating, concentration, and treatment methods for radioactive wastes. (T.R.H.)

8319

THE LIQUID ENTRAINMENT AND ITS REMOVAL FOR A LARGE SCALE EVAPORATION UNIT. EVAPORATION OF RADIOACTIVE LIQUID WASTE. N. Mitsuishi, S. Sakata, Y. Matsuda, and Y. Yamamoto (Atomic Energy Research Inst., Tokyo and Univ. of Tokyo). J. Atomic Energy Soc. Japan 1, 363-9(1959). (In Japanese)

A large scale evaporation unit consisting of evaporator, cyclone, and packed tower was constructed, with which studies were made of the liquid entrainment and its removal. The results obtained are as follows: (1) the decontamination factor of the evaporator lies between 10^4 and 10^5; (2) that of the cyclone is in the range of 10 to 10^2; (3) the over-all decontamination factor of the evaporation unit lies between 10^6 and 10^7; (4) the optimum vapor mass velocity in the vapor space of the evaporator is about 2000 kg/m^2hr. With this optimum vapor mass velocity, the maximum over-all decontamination factor is obtained. The results obtained by the large scale evaporation unit were compared with that obtained by the small scale evaporation unit. (auth)

8320

VAPORIZATION AS A METHOD FOR THE DECONTAMINATION OF RADIOACTIVE WASTES. [PART] I. S. Krawczynski (Kernreaktor Bau- und Betriebsgesellschaft m.b.H., Karlsruhe, Ger.). Kerntechnik 1, 15-21(1959) July. (In German)

The preliminary research on the decontamination of radioactive aqueous concentrates with a rotary blade evaporator is described. The evaporator is sketched, and

the research arrangement, results, materials, and operation monitoring are considered. (tr-auth)

8321

VAPORIZATION AS A METHOD FOR THE DECONTAMINATION OF RADIOACTIVE WASTES. [PART] II. S. Krawczynski (Kernreaktor Bau- und Betriebs-Gesellschaft m.b.H., Karlsruhe, Ger.). Kerntechnik 1, 60-6(1959) Aug. (In German)

Typical evaporators used in the decontamination of radioactive wastes are described with a discussion of the pot evaporator, the Robert evaporator with a thermosyphon system, a modified Vogelbusch evaporator, and a forced circulation evaporator. Methods for the reduction energy and operating costs are also discussed. (J.S.R.)

8322

THE TREATMENT OF RADIOACTIVE WASTES FROM THE KARLSRUHE ATOMIC RESEARCH CENTER. S. Krawczynski (Kernreaktor Bau- und Betriebs-GmbH., Karlsruhe, Ger.). Kommunalwirtschaft No. 9, 8p. (1959) Sept. (In German)

The sources, quantities, and compositions of radioactive waste materials from various operations are described, and methods of treatment are discussed. Sampling, decontamination, precipitation, and evaporation procedures are included. (T.R.H.)

8323

RADIOACTIVE CONCENTRATOR AND RADIATION SOURCE. L. P. Hatch (to U. S. Atomic Energy Commission). U. S. Patent 2,918,700. Dec. 29, 1959.

A method is presented for forming a permeable ion exchange bed using Montmorillonite clay to absorb and adsorb radioactive ions from liquid radioactive wastes. A paste is formed of clay, water, and a material that forms with clay a stable aggregate in the presence of water. The mixture is extruded into a volume of water to form clay rods. The rods may then be used to remove radioactive cations from liquid waste solutions. After use, the rods are removed from the solution and heated to a temperature of 750 to 1000°C to fix the radioactive cations in the clay.

8324

SELF SINTERING OF RADIOACTIVE WASTES. T. N. McVay, J. R. Johnson, E. G. Struxness, and K. Z. Morgan (to U. S. Atomic Energy Commission). U. S. Patent 2,918,717. Dec. 29, 1959.

A method is described for disposal of radioactive liquid waste materials. The wastes are mixed with clays and fluxes to form a ceramic slip and disposed in a thermally insulated container in a layer. The temperature of the layer rises due to conversion of the energy of radioactivity to heat boiling off the liquid to form a dry mass. The dry mass is then covered with thermal insulation, and the mass is self-sintered into a leach-resistant ceramic cake by further conversion of the energy of radioactivity to heat.